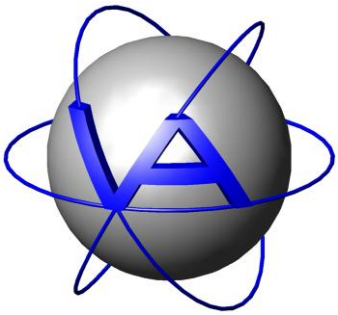
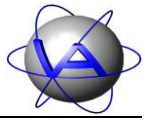


GPS Plus Collar Manager

User's Manual

Version: 3.11

Last Change: 09.08.2011



	Name	Date	Signature
Prepared by	V. Zimmermann	13.05.2009	
Edited by	A. Krop-Benesch	09.08.2011	
Checked by			
Approved by			
Authorised by			

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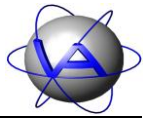

DOCUMENT CHANGE RECORD

Issue	Date	Item(s) Affected	Description
1	26.09.2001	-	Initial Issue
2	09.10.2001	Fig 2 & 3	Changed to new look
3	19.12.2001	Almost all	Added new program features Added more figures for better understanding Added appendix structure
4	02.01.2002	Telemetries Collar Initialisation	Added GSM functionality; changed figures and description
		Error Messages	New Message (Could not open Com Port) Forgotten Message (Com Port not open)
		Tools	Added GSM to UART; changed figure and description
5	18.01.2002	Screenshots main window	New images because of tool bar and status bar
		Division structure	Main heading for each device (Collar, GSM, Terminal
		GSM	Added GSM command descriptions
6	05.02.2002	Screenshots, Description	New images of UTC Correction, File menu, GPS Data
7	14.02.2002	Lifetime calculation	Changed scheduler figure & description, added lifetime calculation
8	03.04.2002	Terminal functionality	Added Terminal commands, data handling and configuration
9	18.04.2002	Beacon Schedule	Added Beacon Schedule Commands Changed Scheduler and upload to handle beacon schedules to

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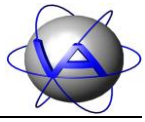

		Read Complete Flash and EEPROM	Added new collar tools: Read complete flash and read complete eeprom
10	25.06.2002	4.1.4 Create Beacon Schedule	Correct the note: VHF Beacon is switched off after the last End Date
11	01.10.2002	Collar Tools	New Commands: UHF Beacon On, Erase All Data, Store & Restore Configuration
		Collar Telemetry & Ext. Telemetry	New field added: Average Fix Time
		Data Viewer Activity & GPS	New Commands in Menues and Toolbar buttons for viewing of data files
		GSM Base Station Mode ff.	New information window showing newly received SMS messages
12	18.11.2002	Added Calc Lifetime	Command in its own in all three modes
		Added Auto Read	Reading SMS Auto Read Button
		Added GSM send schedule	New Commands: Send GPS Schedule and Send VHF schedule
		Schedule Menu	Menu items of all schedule menus have changed (see above changes)
13	23.01.2003	Telemtries	Changed to tabbed display Added Hibernation configuration information Added VHF Frequency
		Collar Initialization	Added VHF Frequency
		Collar Configuration	Added Hibernation Configuration
		GSM	Added Pin transfer description
14	06.02.03	Autostart Autoread	Added “Start in GSM Autoread Mode” to file menu
15	09.04.03	Collar Telemtries	Changed Images (new tab name, FlagReg3) Changed Tab descrtiptions in Appendix

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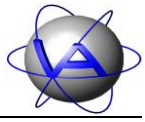

		Schedule Menues	Changed Images (menu), order of chapters
		Upload Schedule	Updated all Images, UTC/LMT correction method changed
		Download Schedule	UTC/LMT correction method changed
		Collar Configuration	Form extended. Further description.
		Collar Initialisation	Form extended (Schedule (un-)locked). Further description.
		Save Collar Information/Configuration	New Images for command/Configuration Menu; new commands descriptions
		Save Terminal Information/Configuration	New Images for command/Configuration Menu; new commands descriptions
16	02.05.03	Collar Upgrade Management	New commands: file – upgrade collar, configuration-create collar upgrade file
		Memory Bank Backup	New commands: terminal command – memory bank backup / memory bank restore
		Collar Information/Configuration	Extended information in files, changed sample files
17	17.06.2003	Options form	Initial chapter, removed options from other command descriptions New features: Auto-Merge, Auto-Export
		Upload GDF/ADF	New Handheld Terminal Commands
		Transfer/ Collar ID's	Headings of lists changed
18	28.09.2004	General	Update figures to new look
		New chapter	Added Chapter Registering Subsystems
		USB Installation chapter	Adapted to identifiable USB devices added step by step instructions
		Changed chapter	GSM Collars changed to GSM Collar

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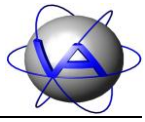

			Numbers & Modes; content changed to new program version
		New Chapter	Mail Reception
		New Chapter	Options with tab sheet descriptions
		Export	Added database export functionality to all export descriptions
		Added functionality	Drag and Drop functionality for position chart
		Com en-/disable	Added Communication en-/disable functionality to: Configure Collar
		Collar Status	added two new statuses: GSM idle, GSM active
		New Chapter	Collar upgrade
		New Chapter	Collar: Get All Data
		New Chapter	Collar: Erase All Data
		Extended Tools	New look of Collar tools and new command: GPS to UART
		New Chapter	Collar: Create Collar Upgrade file
		New Chapter	Collar: Create GeoDLL Key
		New Chapter	Collar: Create Mail Key
		New Chapter	Collar: Fast Export Information and Configuration
		Extended Send Schedule	Added GSM transmit and store SMS functionality in GSM mode
		Extended Get SMS messages	Added transmit functionality and Send Messages button
		New Chapter	Terminal: Get Fix Data command

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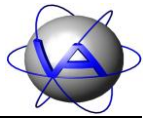

		New Chapter	Terminal: Erase Fix Data command
		New Chapter	Terminal: Get Activity Data command
		New Chapter	Terminal: Erase Activity Data command
		Removed Chapter	Terminal: Get Data
		Removed Chapter	Terminal: Erase Data
		Removed Chapter	Terminal: Transfer/Configure Collar ID's
		New Chapter	Terminal: Manage Data, replaces removed chapters
		New Chapter	Terminal: Memory Bank Backup
		New Chapter	Terminal: Memory Bank Restore
		New Chapter	Terminal: Fast Export Information and Configuration
		Index Added	Added Index for better navigation
19	18.02.2005	Mail Reception	Updated: Recent Error Messages added (Image and Text)
		Mail And SMS Reception	Updated: Recent Error Messages added (Image)
		Options – Mail Message	Updated: Body of Mortality Message (Image)
		Options – Misc	Added: Sound Check Box, Mortality SMS forwarding, and Base Data Path (Image and Text)
		Options – Misc	Correction: UTC – LMT replaced by LMT-UTC
		Appendix E: Time Zones	Correction: UTC – LMT replaced by LMT-UTC
		GPS Show Chart	Added: Hide lines, file name in caption

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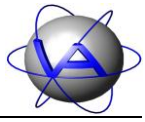

			(Image and Text)
		Activity Show Chart	Added: File name in caption (Image and Text)
		Collar Configuration	Changed: Menu description incomplete
		Collar Configuration	Added: Factory Initialisation
		Collar Configuration	Added: Test Terminal
		Collar Configuration	Added: Store All Collar Data
		Get SMS Messages	Updated: (Images and Text)
		GSM Status	Updated: Network information (Images and Text)
		GSM Commands	Added: Configure GSM Mode
20	06.06.2005	Options	Size of form changed
		Options	Transformed height removed
		Options	TCP/IP added to miscellaneous tab sheet
		GPS Data	Warmstart/coldstart/monitor added to caption
		Export	Removed transformed altitude
		File header editor	Added to configuration menus
		GSM Configuration menu	Added new item to main GSM menu with two commands: file header editor and configure collar via GSM
		Transformation	New Coordinate and Reference systems added to list
21	19.01.2006	Options	Geo transformation tab sheet figure and description (region/country selector)
		Coordinate Systems	Update List, New layout (simpler)

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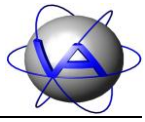

		Reference Systems	Update List, now two lists: All systems and systems sorted by country/region
22	26.04.2006	Options	Added some new options in SMS Handling and Export
		Configure GSM Mode (Collar mode)	Changed a Caption in the form
		Edit File Header	Completely new Form
		Send GPS Schedule (GSM mode)	Form now allows multiple collars to be selected
		Coordinate & Reference Systems	Added new coordinate and reference systems for Japan
23	26.06.2007	General	Almost all images changed to XP look
		USB Driver	Driver installation shortened, extensive description in hardware manual
		GPS Schedule	Completely revised because of new Interface
		Lifetime Calculation	Completely revised because of new Interface
		Options	Many changes applied
		Collar Configuration	Added new features (Argos, Activity, etc.)
		Terminal	Add new chapter for terminal command description of V2.x terminal software
		Argos Schedule	Added Argos Schedule commands and forms
		Collar Telemetry Data	Added Argos tab sheet, changed activity group box
24	12.03.08	Mail Reception	Iridium integration and SMTP BOT button
		Mail, SMS and Argos Reception	Iridium integration

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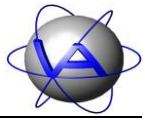

		Collar List	Iridium IMEI and Study Period
		Options	SMS Handling: Auto Mail: Iridium Mail Server: Enable SMS Email Reception New Tab Sheet: Iridium Server Misc: Start Mail Autoread
		New Chapter	Edit GSM Schedule
		New Chapter	Write GSM Schedule
		New Chapter	Read GSM Schedule
		Set Collar Time	Redesigned Dialog
		Collar Telemetry	GSM tab changed to GSM/SatComm
		Collar Configuration	Iridium Mode Activity Mode 7
		Collar Commands	New menu item added: Clear Argos Buffer
		Collar Initialization	VHF Beacon Power Iridium Mode
		Update Chapter	GSM – Send GPS Schedule: Divided into two sub chapters: Via GSM and Via Iridium
		Update Chapter	GSM – Configuration – Configure Collar: Divided into two sub chapters: Via GSM and Via Iridium
		Appendix B	GSM tab changed to GSM/SatComm Added new fields
25	27.01.2009	File Menu	Added “Process messages of unregistered collars” and “Convert all SMS to ZIP-files”
		Mail Reception	Added Globalstar FTP processing feature to mail reception
		Unprocessed messages	Added chapter and figure for new command in file menu

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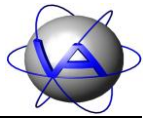

		Convert SMS to ZIP	Added chapter and figure for new command in file menu
		Collar List	Added Globalstar ESN information, update figures
		Options SMS Handling	Added national phone number conversion, updated Figure
		Options Mail Server	Added authentication and SMTP Test button, updated figure
		SMTP Test form	Added paragraph and figure about SMTP server connection test to Options Mail Sever
		Options Iridium	Updated figure
		Options Globalstar	Added chapter Globalstar options with figure
		Options Argos	Updated figure
		Options Mail Message	Updated figure
		Options Export I	Updated figure
		Options Export II	Updated figure
		Options Geo Transformation	Updated figure
		Options Misc	Updated figure
		Schedule Menu	Removed UHF Beacon, updated figure
		Clear GSM schedule	Added chapter
		Collar telemetry data description	Removed UHF on time and period, added Globalstar
		Terminal Schedule Menu	Removed UHF beacon entries, updated figure, removed UHF beacon chapters

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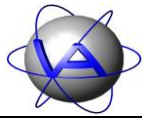

		Collar configuration	Removed UHF On Time and Period, updated figure
		Collar Telemetry	Removed Updated figure
		Configuration menu	Removed Collar Initialisation and Low Level Init, updated figure
26	12.05.2009	Virtual Fences	- Edit, send, receive, and clear via cable - Edit, send, and clear via GSM and Iridium
27	23.06.11	Set-up Base Data Path	Added chapter
		Process unregistered collar messages	Added chapter
		Database	- New database connection column in collar list - New database connections configuration form
		Play Beacon Sound	Added chapter
		GSM/Iridium Schedule	Updated chapter
		Shortcuts for Collar Status and Telemetry	Added paragraph
		Lifetime Calculation	Reorganisation of chapter
		Collar Configuration in Collar Mode	Updated entire chapter
		GPS Tracking Time	Added chapter
		RF Communication Time	Updated chapter

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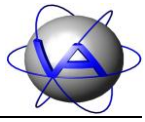

		SMS Reception Delay	Added chapter
		Proximity Sensor	Added chapter
		Convert SMS to ASCII	Added figure
		GSM/Iridium Remote Configuration	Reorganisation of chapter, added chapters
		Collar Configuration in Handheld Mode	Updated entire chapter
		Send/Receive Argos Schedule	Added chapter
		Position Transmission	Added
		"Backup Battery"	Change of name into "Beacon Battery"
28	03.08.2011	Download schedules from handheld terminal	Status messages fully explained
29	09.08.2011	Notification email and SMS	Virtual fence and trap event included

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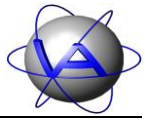

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1 Product overview

The **GPS Plus Collar Manager** is used to configure and read out the **GPS Plus** collars, handle a GSM modem for reception of collar data, and to configure and read out a VHF or UHF Handheld Terminal. GPS measurement times can be configured and position, activity and mortality data can be read out, stored, exported, graphically shown, and erased.

The program is easy to use and mostly self-explanatory. It allows you to keep as many configuration files as needed, which can be used for any collar. Every data file can be stored with any file name, so that it is possible to have multiple files for every collar.

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2 Installation and Configuration

2.1 Program Installation

If this is the first time you install GPS Plus, do not connect any Link Managers and Handheld Terminals. If you update your GPS Plus and have previously used these devices on your computer, you should plug in your USB devices before you start the set-up.

Installation is simple and straightforward. There are two ways to do it. If you use the AutoRun CD which has been delivered with the collars, follow the instructions for "Set-up your system". Alternatively, you can access the installation file with "VECTRONIC Software" "GPS Plus Collar Manager".

If you use an older media (CD, hard disk, or floppy disk) find the file `GPS_Plus_Setup_3_X_X.exe`. Start it and follow the instructions. You can access the latest release version of the software on the VECTRONIC homepage (Wildlife Monitoring → Downloads).

The installation procedure will ask you for a destination directory and suggest a default directory. You can now decide whether you want to install one of the following software packages (list might vary with program versions) :

- the GPS Plus Collar Manager (this is the GPS Plus program)
- the NMEA Player (to display GPS positions)
- the Colour Selector (to order coloured collar belts)
- the TeamViewerQS VAS (Remote Desktop Support on demand).

2.2 USB Driver Installation

If automatic installation/update of the USB drivers did not work for you, you either have to update (if an old version is already installed) or install the drivers manually. The following sections will give you brief instructions. For further explanations see the Link Manager and the VHF/UHF Handheld Terminal manuals.

2.2.1 First time driver installation

If the device (Link Manager or Terminal) was never used on this computer, you have to install the drivers manually. To do this, plug in the USB device. Windows will recognize a new device. Follow the instructions and select other sources in order to be able to select a directory. Then select your program directory (GPS_Plus), open the FTDI folder, and select the file "FTDIBUS.INF". Open it, press OK and continue. Windows will warn you that this driver might be insecure and the source of the driver could not be identified. Ignore this

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warning and continue. After Windows has finished installing the driver, the device can be used.

2.2.2 Driver update

To Update a driver you have to use the Device Manager. Open the windows Control Panel and double click System. Then select Hardware from the Tabs. Click on Device Manager on this tab. Go to the USB-Controller node and expand it to see all connected USB devices. Select the USB device (it can have the following names: GPS Plus Link Manager, GPS Plus Handheld Terminal, or, if you have a rather old version, USB Serial Converter). For all devices you find do the following: Left-click on the Entry and select update driver. Then follow the instructions for new installations (see 2.2.1 First Time Driver Installation).

2.3 Starting the Program

After installation, the program can be started without rebooting windows. Just start the **GPS_Plus** program from the windows start menu. The program will create several sub-directories in the program directory at first start.

The *About* Box will show up (see Figure 1). You may click on the OK button or wait for five seconds to make it disappear. It can be brought up again at any time by clicking on the logo in the centre of the main form or via the file menu *About* item. The *About* Box contains two links, a link to the homepage of VECTRONIC Aerospace and an email link to VECTRONIC Aerospace, and list of licensed subsystems.

Figure 1: About Box showing at program start

If a serial interface is used by some other device (i.e. mouse), chances are that the program will show up with an error message. This is because it will try to gain control of COM1 even if this is already used. Change the port in the *Com Port* Menu to the one to which the collars will be connected via the Link Manager. You have to set the COM port in any case, not only if the error message appears. The program will remember this setting and it is not necessary to set it again at the next program start. This is all what is needed for the first start of the program.

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2.4 Base Data Path – differences in Windows Vista and Windows 7

Due to User Access Control (UAC) in Windows Vista and Windows 7, GPS Plus is not allowed to write data into the folder in which it has been installed as has been the case with older Windows versions ([program files]\GPS_Plus). Instead, data are stored in the Virtual Store (C:\Users\[USERNAME]\AppData\Local\VirtualStore\Program Files\[GPS_Plus]).

The Virtual Store folder is configured to be hidden in Windows and cannot be seen by the user from the windows file explorer or GPS Plus in the standard configuration of windows. To access the Virtual Store folder, open the Windows control panel and doubleclick on "Folder Options" or, if you are in the category view, "Appearance and Personalization" and then "Folder Options". In the next dialog, select the view tab (Figure 2). In the lower part of this tab, locate the "Hidden files and folders" option in the Advanced settings and select "Show hidden files and folders. Click OK on the "Folder Options" dialog. Now all hidden files and folders are visible in the windows explorer.

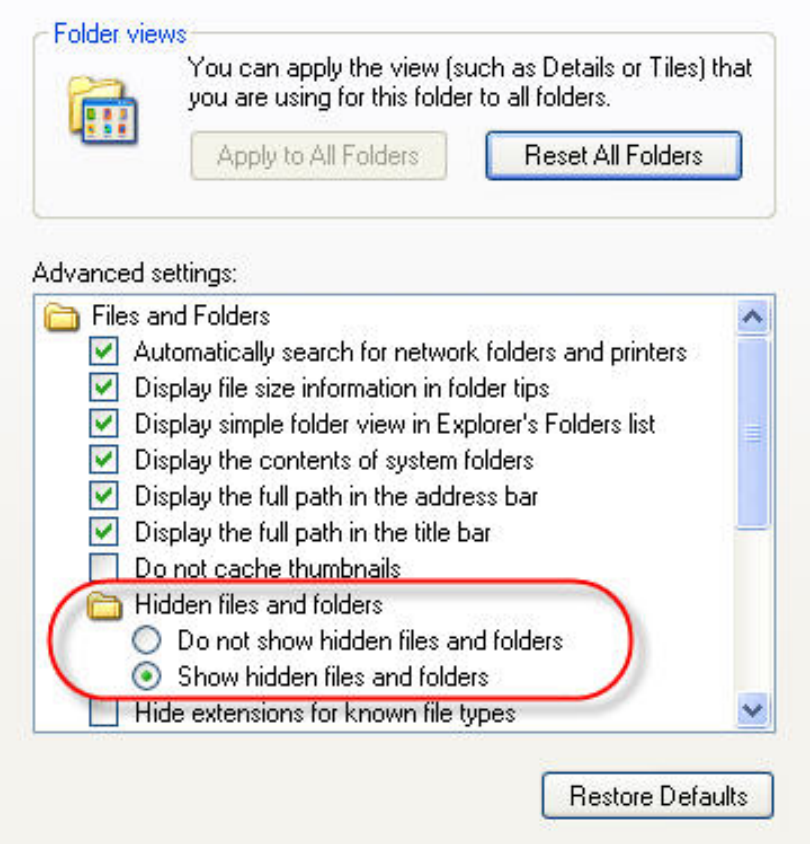
Folder views
You can apply the view (such as Details or Tiles) that you are using for this folder to all folders.
Apply to All Folders
Reset All Folders
Advanced settings:
Files and Folders
Automatically search for network folders and printers
Display file size information in folder tips
Display simple folder view in Explorer's Folders list
Display the contents of system folders
Display the full path in the address bar
Display the full path in the title bar
Do not cache thumbnails
Hidden files and folders
Do not show hidden files and folders
Show hidden files and folders
Hide extensions for known file types
Restore Defaults

Figure 2:Settings for Folder View in Windows Vista

The necessary change of the data path from the program folder to the Virtual Store folder is not done automatically. Please refer to 3.1.8.10 Miscellaneous Tab Sheet on how to do this.

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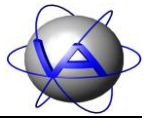

2.5 Registering Subsystems

There are two subsystems that have to be paid for to use them: The coordinate transformation and the mail reception.

The coordinate transformation allows you to transform the ECEF (earth centred earth fixed) and geographic coordinates, as provided by GPS Plus as standard when exporting, to one of over 90 coordinate systems (see Appendix F: Available Coordinate Systems) with over 50 different reference ellipsoids (see Appendix G: Available Reference Ellipsoids). Even user-defined coordinate systems are possible. If you purchase this subsystem, you will receive a file named `GeoDLL_Access.Key`. It contains your name and/or institutions name, your address, and a coded key. Just copy this file into your program directory (where GPS_Plus.exe is stored) and restart your program. The program will notice the existence of the file at the next start and check it.

The same applies for the mail reception subsystem. Only the file name is different: `MailReception_Access.Key`. The mail reception subsystem allows you to automatically read, store, merge, and export SMS messages received by email; this saves you to store the attachments manually, then merge and export them.

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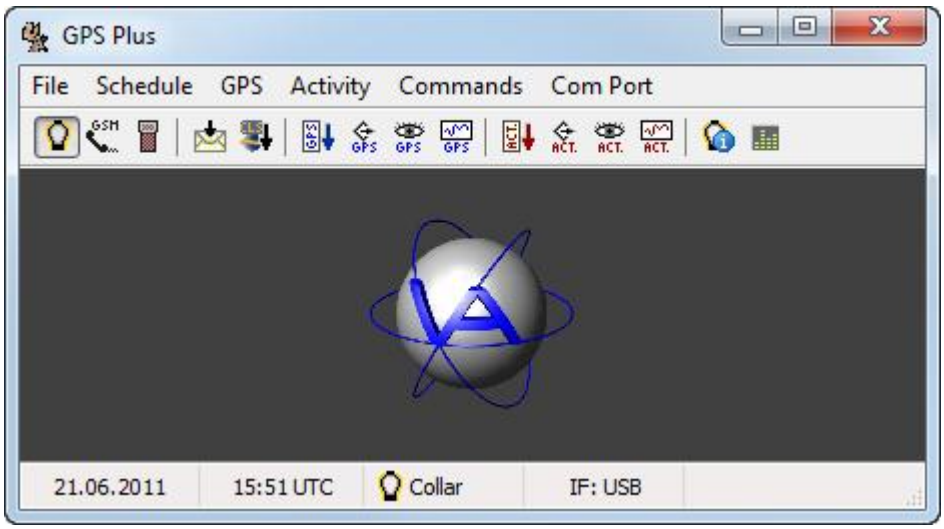
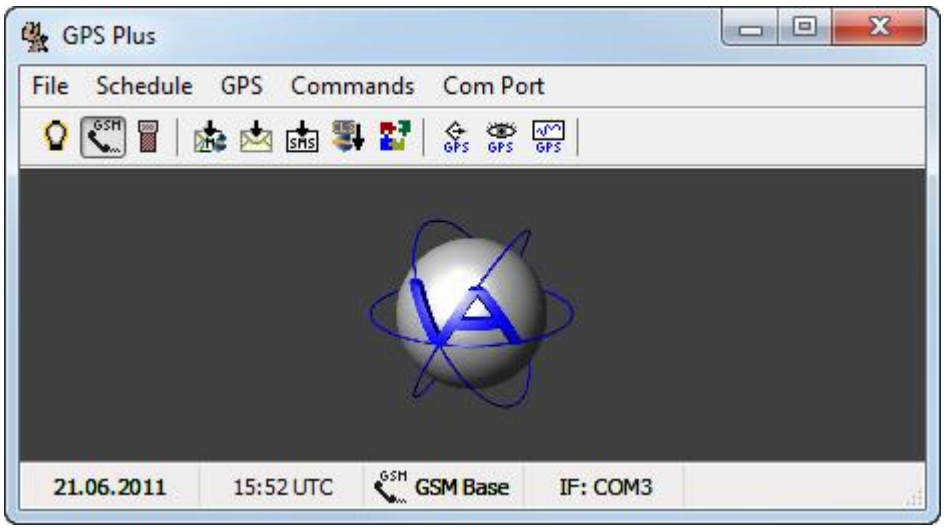
3 The Main Window

The program is a sizeable window with a centred logo. On top there is a pull down menu bar with a toolbar below. Every action is done via this menu and the toolbar. The status bar at the bottom shows time and date in UTC derived from the computer time, the device selected (Collar, GSM Base Station, or Handheld Terminal) and the commands available for this device.

First select the device with which you want to communicate via the first three buttons of the toolbar or via the corresponding entries in the *File* menu. The main menu as well as the toolbar change whenever you change the mode. The toolbar shows only the most important commands of the selected device. The device and the corresponding interface are updated in the status bar at the bottom.





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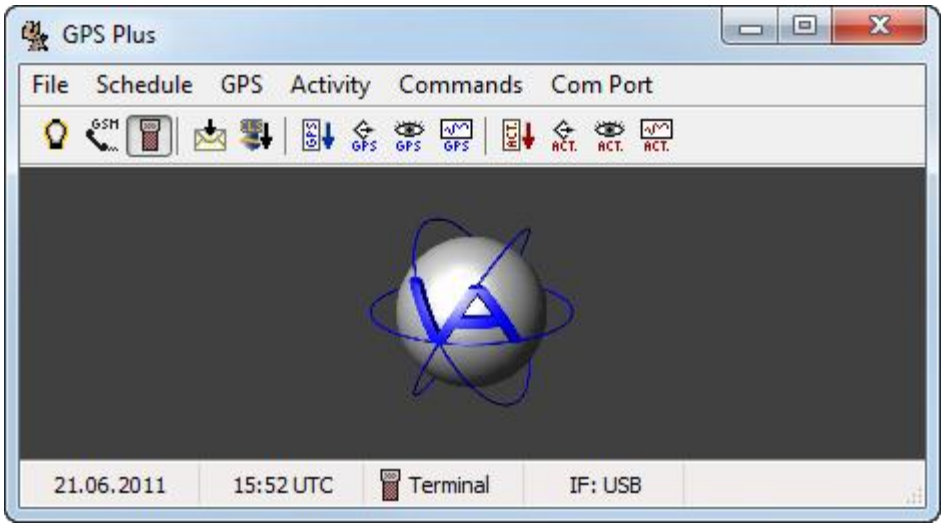

Figure 3: Program main window in collar (top), GSM base (centre), and terminal mode (bottom)

The different menus (except *File* menu), their entries, and the toolbar are described in the following chapters corresponding to the devices Collar, GSM Base and Handheld Terminal. The menus differ between modes, though some commands are the same. The *File* menu will never change; therefore it is described in this chapter. The *Activity* menu on the other hand disappears completely in GSM Base mode, because it is not possible to access activity data via the GSM Base Station.

For the use of the program, the collar should be deactivated with the provided magnet and the deactivation checked with the telemetry command.

3.1 File Menu

The items in the *File* menu serve mainly general program configuration purposes. *About* opens a window which contains information about the program version and how to contact to our company. *Close* closes the program. This is the same as clicking the small cross in upper right corner of the program. All other entries are explained in separate chapters following this one because of their complexity.

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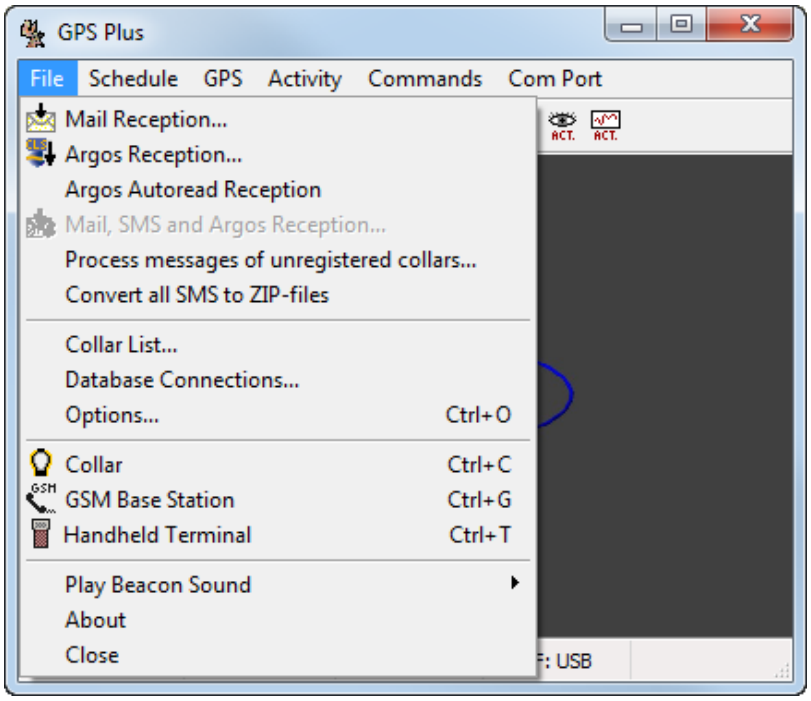

Figure 4 : File menu

3.1.1 Mail Reception

This feature is NOT part of the free version of GPS Plus. You will have to purchase a Mail Reception Key from VECTRONIC Aerospace to use it (see 2.5 Registering Subsystems)!

With this form (see Figure 5) you can easily read, store, merge, and export SMS messages contained in emails, Position data mailed from the Iridium or Globalstar service. To use it, you need to configure the Incoming Mail Server Options (3.1.8.2 Mail Server Tab Sheet) for reception of emails sent by a GPS Plus program, the Iridium Server Options (3.1.8.3 Iridium Server Tab Sheet) for reception of emails coming from the Iridium service, and the Globalstar Options (3.1.8.4 Globalstar Tab Sheet) for processing of Globalstar files on a FTP server.

The form contains a Progress Log area on the left displaying what the program is currently doing, a drop down list showing the last error messages at the bottom, and the four buttons Read Mail , Auto Read , Stop , and Show SMTP . The Stop button should be disabled when the form comes up unless it is invoked by autostart (see section 3.1.8.10 Miscellaneous Tab Sheet).

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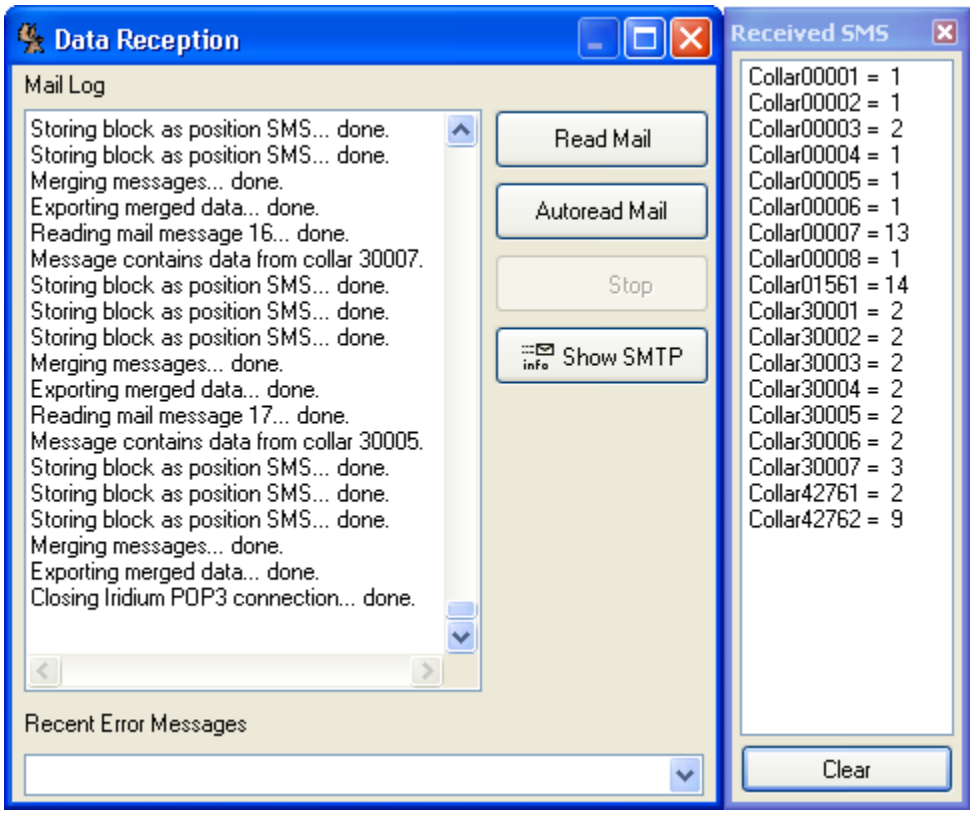

Figure 5: Mail Reception form with 1 email read and the received messages list left to it

Pressing the Read Mail button changes the stop button from disabled Stop to enabled Stop and will start the reading of the configured sources. First, the connection will be established and the user is authenticated. Then the program checks the number of emails currently available on this account. Now all emails are read one after the other. If an email has a subject containing the string ”Data for Collar” and it contains at least one attachment with a filename containing the string “Collar” and the extension ”SMS” then the file is stored in the SMS-subdirectory of the base data path. It will automatically be merged and exported if the appropriate options are checked (see 3.1.8.1 SMS Handling Tab Sheet). The program will also recognise multiple attachments. These will not be sent by GPS Plus but can be send manually provided they confirm with the rules described earlier. After all emails have been read, the command closes the connection again. It can be stopped at any time by pressing the Stop button.

Pressing the Auto Read button changes the stop button from disabled Stop to enabled Stop and will start the reading of the configured email account. Different to Read Mail, this command will not stop after reading all emails. It will instead pause for the time defined in the options (see 3.1.8.10 Miscellaneous Tab Sheet) and then start over again. It can be stopped at any time by pressing the Stop button.

If the Stop button is pressed, it changes to Stopping... and finishes the current process. Then it will stop reading mails. The stop button is disabled and changed to its initial look.

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At the first occurrence of the data reception form the received messages form may not be visible. It will show up when the first message is received. Every stored SMS file will then increment the entry in the received collars list or, if it is the first occurrence of this collar ID, will add the ID to the list.

3.1.2 Argos Reception

This form allows retrieving data from a Argos Centre via a telnet connection. You got to have Argos configured to use this form properly (see 3.1.8.5 Argos Tab Sheet).

The form consist of a main menu, a tool bar, a text area containing progress information, a Log area displaying the actual communication with the Argos centre, and a status bar. At start, only the Connect command is possible. All other commands are disabled.

It connects to the Argos centre telnet server according to the configured options (see 3.1.8.5 Argos Tab Sheet). After a connection is established it automatically logs in with the configured username and password. If login is successful all other commands are enabled. It is not possible to close the form while you are connected.

Disconnect logs off the telnet server and closes the connection. After that the form can be closed. It is not possible to close the form while you are connected with the Argos centre.

Get data from selected collar retrieves the data of the selected collar (see toolbar: Collar ID) from the last ten days. This is the maximum period of time provided by the Argos centre. It does this with the Argos PRV command. You will see the incoming data in the lower Log area. The upper text area shows what GPS Plus is doing with this data. While getting data all commands are disabled.

Get data from all listed collars retrieves the data of all listed collars (see toolbar: Collar ID) from the last ten days. This is the maximum period of time provided by the Argos centre. It does this with the Argos PRV command. You will see the incoming data in the lower Log area. The upper text area shows what GPS Plus is doing with this data. While getting data all commands are disabled.

Get pass information for selected collar retrieves positions of the current collar determined by Argos and not by the GPS module on the collar. It does this with the Argos DIAG command. You will see the incoming data in the lower Log area. The upper text area shows what GPS Plus is doing with this data. While getting data all commands are disabled.

Get pass information for all listed collars retrieves positions of all collars listed determined by Argos and not by the GPS module on the collar. It does this with the Argos DIAG command. You will see the incoming data in the lower Log area. The upper text area shows what GPS Plus is doing with this data. While getting data all commands are disabled.

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In order to select a collar use this drop down list. It contains all collars of your collar list with an Argos ID.

The Show SMTP Mail Delivery System command opens a form showing the delivery of retrieved position data via mail to configured recipients. You will find more information on this form in 3.1.2 Argos Reception.

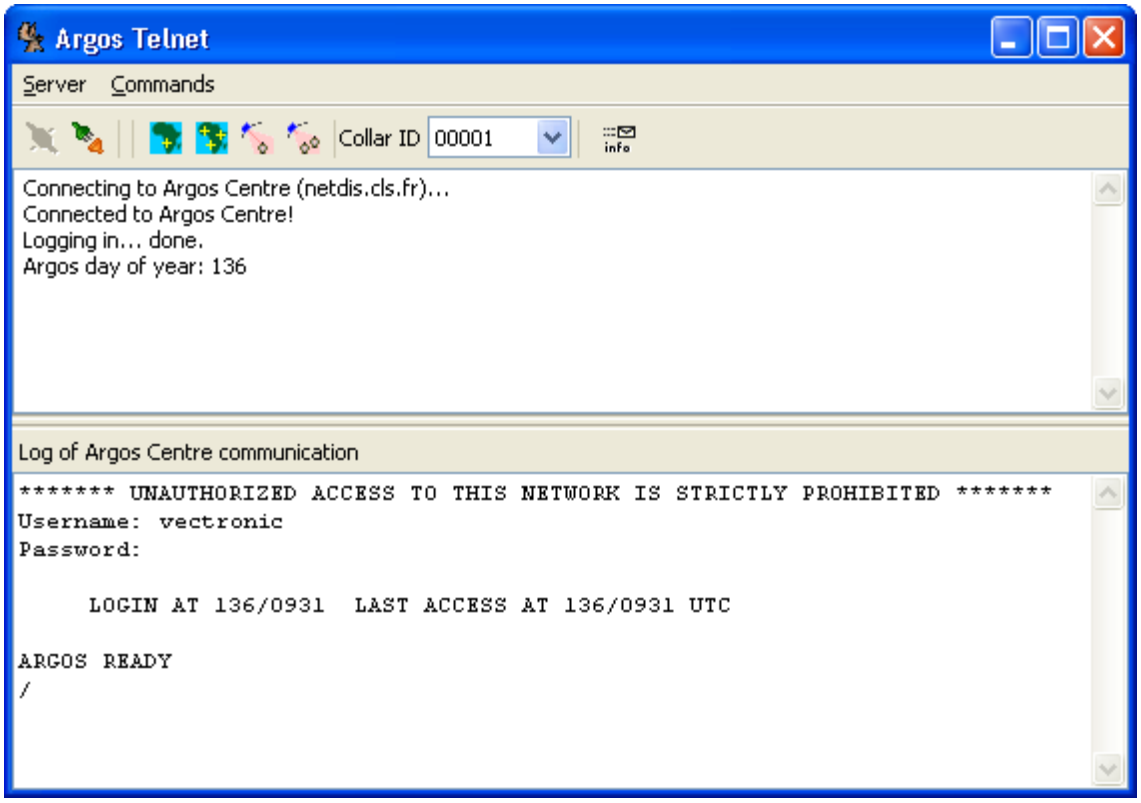

Figure 6: Argos Telnet Form after login

SMTP Send Bot

Since emails are send on multiple occasions in GPS Plus, there is a form to configure email communication. Emails are sent in the background, whenever GPS Plus has some spare time (in this case a few milliseconds in between). Forms that use this little helper allow you to have a look this SMTP Robot by clicking on a button with this logo.

The form itself (Figure 7) consists mainly of two test areas: The left shows the communication with the SMTP mail server and the right shows the queue of files to send. The queue also lists the collar ID to which the file is associated to. Via this ID the form retrieves the destination address(es) from the collar list. If the extension of a queued file is .SMS it uses the position mailing list. Otherwise it uses the mortality mailing list.

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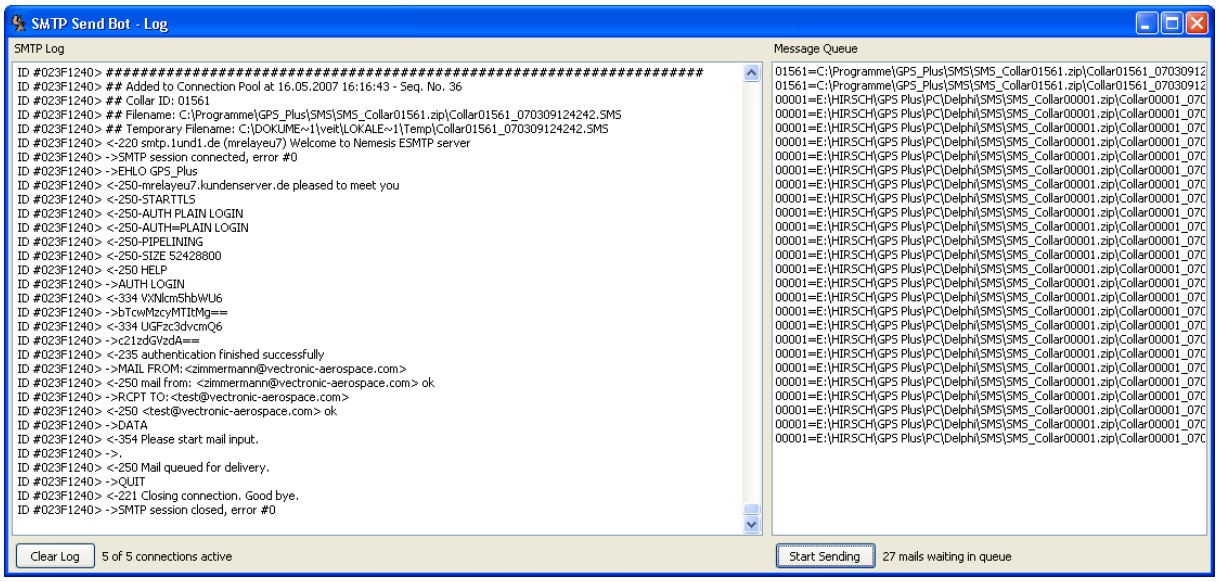

Figure 7: SMTP Send Bot form sending emails

3.1.3 Mail, SMS and Argos Reception

With this form (see Figure 8) you can easily read, store, merge, and export SMS messages either received directly, contained in emails, or from an Argos telnet connection. To use it, you need to configure the Incoming Mail Server Options (see 3.1.8.2 Mail Server Tab Sheet), the PIN (see 3.1.8.10 Miscellaneous Tab Sheet) and the Argos Telnet Server (see 3.1.8.5 Argos Tab Sheet).

This form unites the functionality of the mail reception (including Iridium) and the SMS message reception form. In fact, all three forms are the same. Parts of the form can be hidden to adapt the look to the current usage. It can also call the Argos Telnet form. For a detailed description of both parts, refer to chapters 3.1.1 mail reception, 3.1.2 Argos reception, and 3.1.3 SMS message reception, please read the appropriate chapters.

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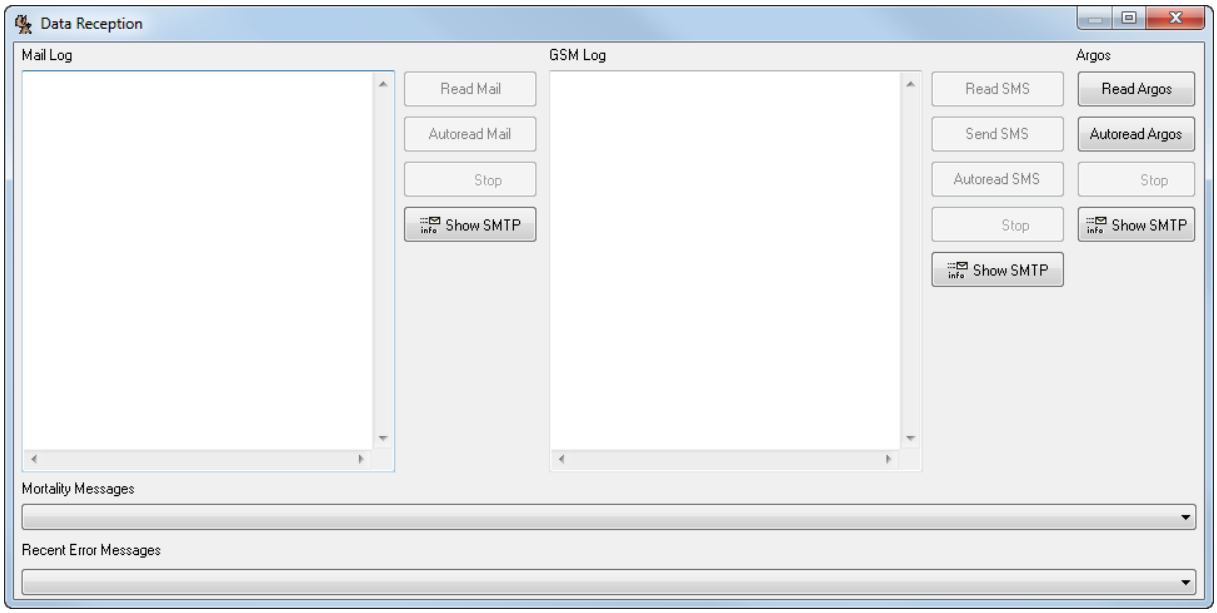

Figure 8: Mail (GPS Plus, Iridium, and Globalstar), SMS and Argos reception form

The combination of the functions is coordinated in the first come first served style: You can start one reception while another one is still running, but the process itself will start only after the first reception process has been finished. When using autoread, the same applies for all receptions: When the time for reception has come (can be adjusted in 3.1.8.10 Miscellaneous Tab Sheet) this process will be completed before another reception is started. If a reception is scheduled to start while another one is still running, the second one will be postponed until the first one is completed. Activation of both data reception parts is guaranteed: If the activation is so tight, that there will be no pause between both activities, the activation will change directly from on to the next.

3.1.4 Process unregistered collar messages

If you receive data from a collar that cannot be identified because there is no entry in the collars list containing its identifier, such as Phone Number, Globalstar ESN, or Iridium IMEI, the message will be stored in special ZIP files. This command processes these messages and helps you to identify the collars.

The function of this form is similar to the data reception. On the left, there is a list of unprocessed messages starting with a keyword indicating the type of communication they were received through: GSM, Iridium, or Globalstar. At the centre is the process log, where the progress of the processing can be monitored. On the right, there are three buttons:

- Selected Messages starts the processing of the currently selected messages.
- All Messages starts the processing of all messages in the unprocessed messages list.
- Stop is only active while processing messages. It stops processing messages after the current messages has been completely processed.

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If a message is received from a collar which phone number is not yet registered, the message will be stored as unregistered message in the zip-folder `GPS Plus\SMS\NotRegisteredCollars_GSM.ZIP`. You can process these messages with File/Process unregistered messages.

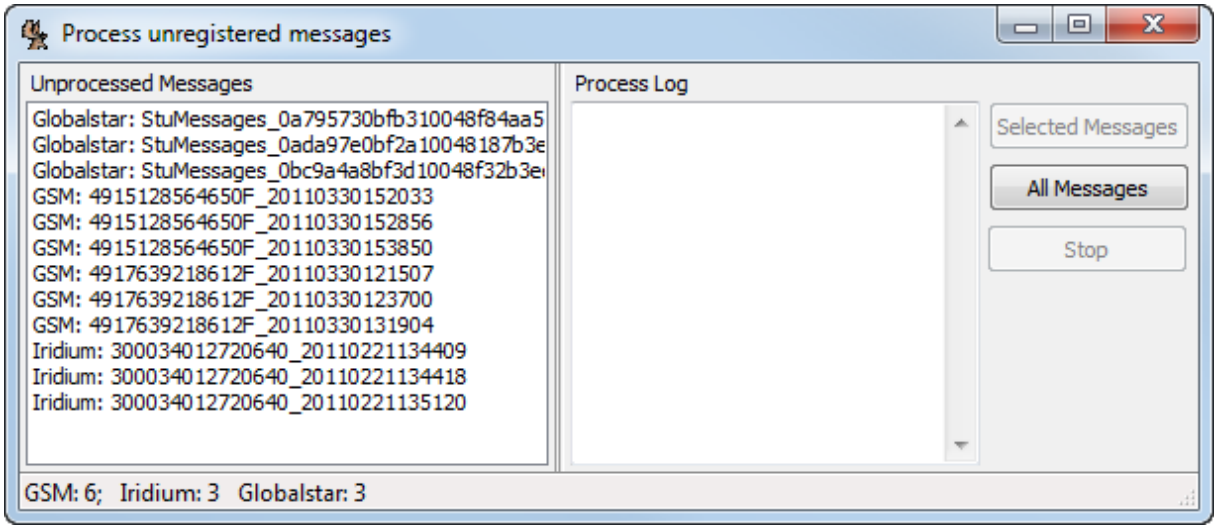

Figure 9: Process unregistered messages dialog

The list Unprocessed Messages (Figure 9) will display all received messages which could not be related to a registered collar. Select specific messages with Select or All Messages. A window will open to ask for the collar ID (Figure 10).

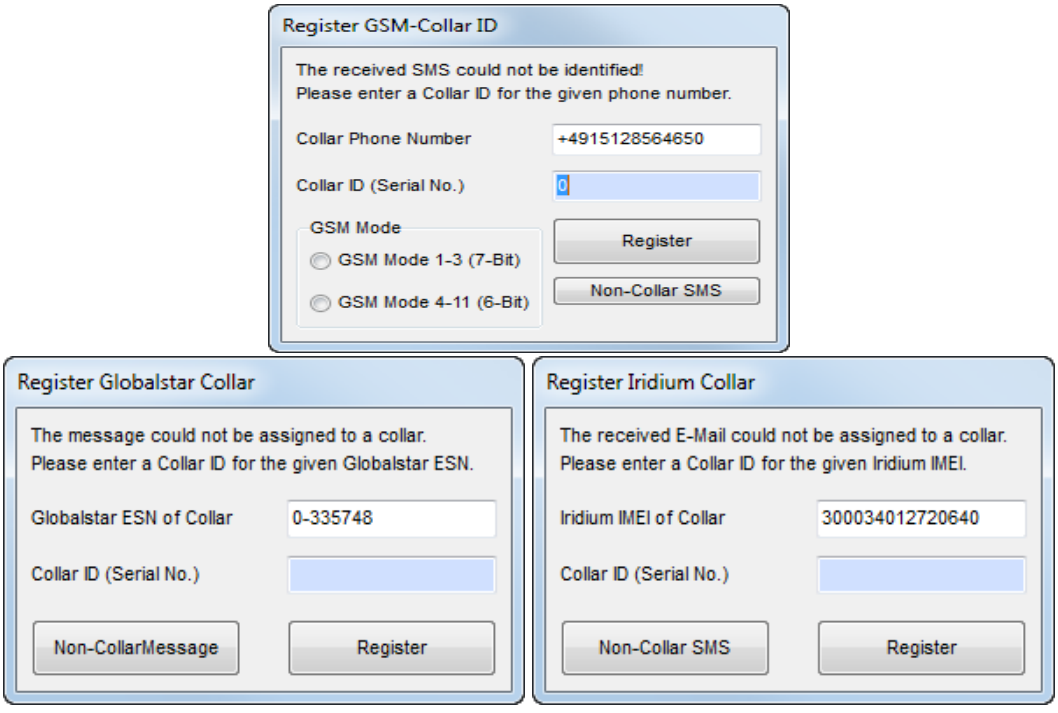

Figure 10: Register GSM phone number, Globalstar ESN, and Iridium Collar ID window

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In this window, you need to associate an ID with the given number and, in case of a GSM message, select the GSM Mode of the collar; normally, a mode will be suggested together with a reason for this suggestion. You will not be able to leave this form until you entered a valid ID or identify the phone number to be not a collar. If you enter an ID that is already registered, you will be asked if you really want to substitute the old number with the new one. Be careful in doing so because this might mess up your data by combining data from two different collars into one data file. After an ID has been set it is stored and needs not to be entered again.

3.1.5 Convert all SMS to ZIP-files

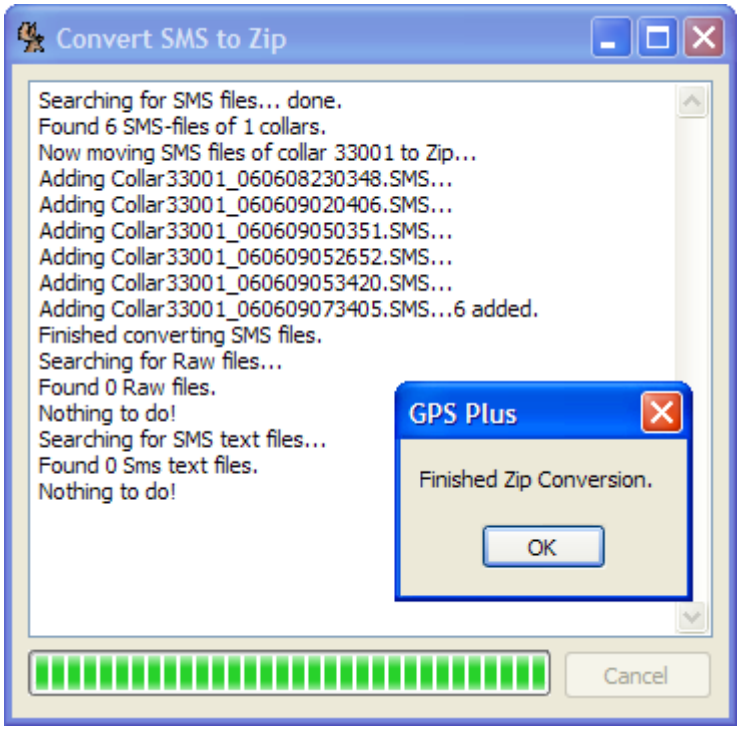

Figure 11: Convert SMS to ZIP files form

Unlike older versions of GPS Plus that stored the SMS files in one folder, GPS Plus Version 2.7.0 or higher stores them in ZIP files, one ZIP file for each collar. This command converts the old structure to the new one.

This command works completely autonomous. If you start it, a window opens up with a log field, a progress bar, and a Cancel button. The conversion process will be started immediately. You can stop it at any point without harm by clicking on the Cancel button; the conversion will just be stopped and no more SMS files will be moved into ZUP files. The conversion can be manually reversed by extracting the SMS files from the ZIP files with a program like Zip Genius or WinZip.

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3.1.6 Collar List

The program needs information about the collars it is supposed to handle. This information is stored in the collar list. To each collar it contains registration information, phone number and SMS coding scheme, Iridium IMEI, Argos ID, Globalstar ESN, Study Period, a position mailing address list, a mortality mailing address list, a mortality SMS phone number list, and a database connection (see Figure 12). You can add, edit, and erase a collar entry. You can also add registration information to an existing entry. By clicking on the column headers you can sort the list by the selected property as key. The first click sorts ascending, the next clicks toggle the sorting order between ascending and descending. The current sorting key and direction are displayed in the status bar. Empty values in the selected column will always be listed last. For identical values in the sorting key, the collar ID will be used as a secondary key.

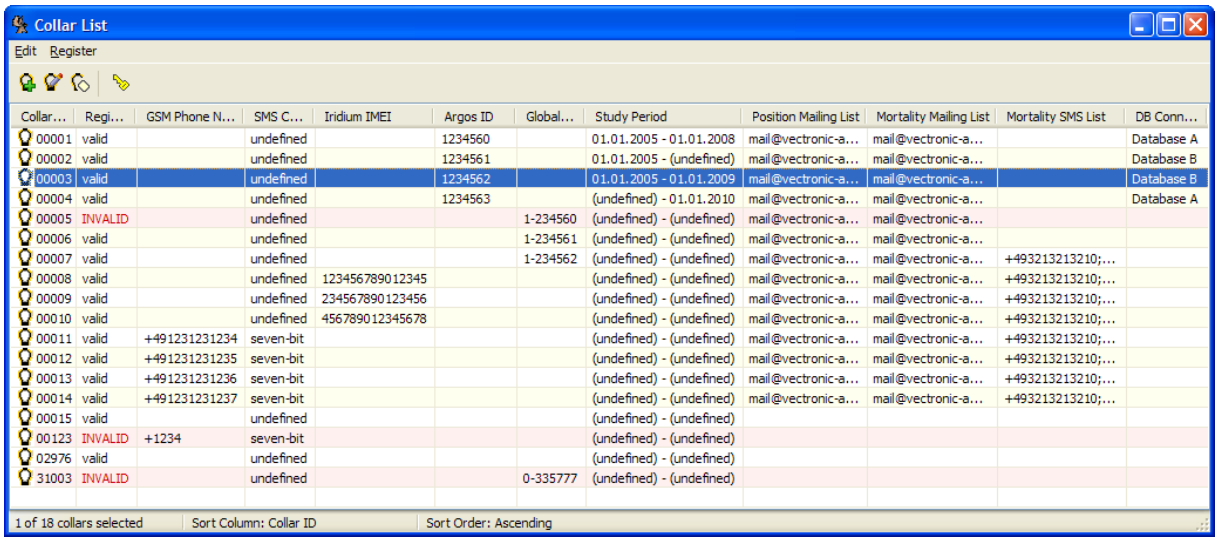
Collar List
Edit Register
Collar... Regi... GSM Phone N... SMS C... Iridium IMEI Argos ID Global... Study Period Position Mailing List Mortality Mailing List Mortality SMS List DB Conn...
00001 valid undefined 1234560 01.01.2005 - 01.01.2008 mail@vectronic-a... mail@vectronic-a... Database A
00002 valid undefined 1234561 01.01.2005 - (undefined) mail@vectronic-a... mail@vectronic-a... Database B
00003 valid undefined 1234562 01.01.2005 - 01.01.2009 mail@vectronic-a... mail@vectronic-a... Database B
00004 valid undefined 1234563 (undefined) - 01.01.2010 mail@vectronic-a... mail@vectronic-a... Database A
00005 INVALID undefined 1-234560 (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a...
00006 valid undefined 1-234561 (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a...
00007 valid undefined 1-234562 (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a... +493213213210;...
00008 valid undefined 123456789012345 (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a... +493213213210;...
00009 valid undefined 234567890123456 (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a... +493213213210;...
00010 valid undefined 456789012345678 (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a... +493213213210;...
00011 valid +491231231234 seven-bit (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a... +493213213210;...
00012 valid +491231231235 seven-bit (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a... +493213213210;...
00013 valid +491231231236 seven-bit (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a... +493213213210;...
00014 valid +491231231237 seven-bit (undefined) - (undefined) mail@vectronic-a... mail@vectronic-a... +493213213210;...
00015 valid undefined (undefined) - (undefined)
00123 INVALID +1234 seven-bit (undefined) - (undefined)
02976 valid undefined (undefined) - (undefined)
31003 INVALID undefined 0-335777 (undefined) - (undefined)
1 of 18 collars selected
Sort Column: Collar ID
Sort Order: Ascending

Figure 12: Collar List form

To add a collar entry click on the Add Collar menu item in the Edit menu, the add collar button or simply by pressing the insert key (Ins) on your keyboard. A form will open up where you can enter your collars data (see Figure 13, left).

To editing a collar entry click on the Edit Collar menu item in the Edit menu, the edit collar button or simply by pressing the enter key on your keyboard. The last choice will edit the active entry in the list. So if you select multiple entries the entry that selected last is chosen. A form will open up where you can edit your collars data (see Figure 13, right).

To remove a collar entry click on the Remove Collar menu item in the Edit menu, the remove collar button or simply by pressing the delete key (Del) on your keyboard. If you select multiple entries, all selected will be removed. A dialog will open up for confirmation, listing all collar IDs that will be removed.

To register a collar click on the Load Key File menu item in the Register menu or the load key button. An open file dialog will open up where you can select multiple collar

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key files (*.key). The files are normally provided together with your collars on a CD. If the keys in the files are valid the registration entry of the corresponding collar will change from invalid (see Figure 12, Collar ID 00005) to valid.

The following collar information can be added:

Collar ID: The Collar ID (also known as the serial number) is the identification of your collar. It has to be a number from 1 to 65534. Other values will not be accepted. IDs with less than five digits will automatically be padded with leading zeros.

Phone number: A valid phone number starts with a plus sign ("+") as international number coding and must have at least four digits (which is of course too short to be a real phone number). Other than the plus sign in the first position, only numerical characters from 0 to 9 are allowed (no spaces or hyphens).

SMS Coding: If you enter a phone number a SMS coding scheme has to be selected. You can find the coding scheme of your collar on the configuration print-outs provided with your collar. In any case GPS Plus will recognise the coding scheme of received SMS messages in almost all cases and correct the entry.

Iridium IMEI: The Iridium IMEI is a 15-digit number identifying your collar's Iridium transmitter. You can check it via the telemetry of the collar or find it in the collar information file provided with your collar.

Argos ID: The Argos ID is a 7-digit number that uniquely identifies a collar's Argos transmitter and thus the collar. You can find it in your Argos documents, your collar's telemetry, or from the collar's information file provided with your collar.

Globalstar ESN: The Globalstar ESN is a electronic serial number that uniquely identifies a collar's Globalstar transmitter and thus the collar. It consists of three parts: A manufacturer ID ranging from 0 to 15, a hyphen, and a serial number ranging from 0 to 8388607. You can find it in your collar's telemetry, or from the collar's information file provided with your collar.

Study Period: This information is used when exporting data of the collar. Only fixes (or activity measurements) taken in the specified range will be exported. An undefined value implies no restriction.

Position Mailing List: This list contains email addresses to which a received collar position will be mailed. Every address has to be in a separate line. Leading and trailing blanks as well as empty lines will be removed and obviously incorrect addresses will not be accepted.

Mortality Mailing List: This list contains email addresses to which a received collar mortality, virtual fence, or trap event will be mailed. Every address has to be in a separate line. Leading and trailing blanks as well as empty lines will be removed and obviously incorrect addresses will not be accepted.

Mortality SMS List: This list contains phone numbers to which a received collar mortality virtual fence, or trap event will be send via SMS. The phone number needs to have the

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same format as the collar phone number. Every phone number has to be in a separate line. Empty lines will be removed and invalid phone numbers will not be accepted.

Database Connection: All position data received in the data reception from the collar will be written to the database configured in this database connection. If the connection does not exist (anymore), the entry will simply be ignored.

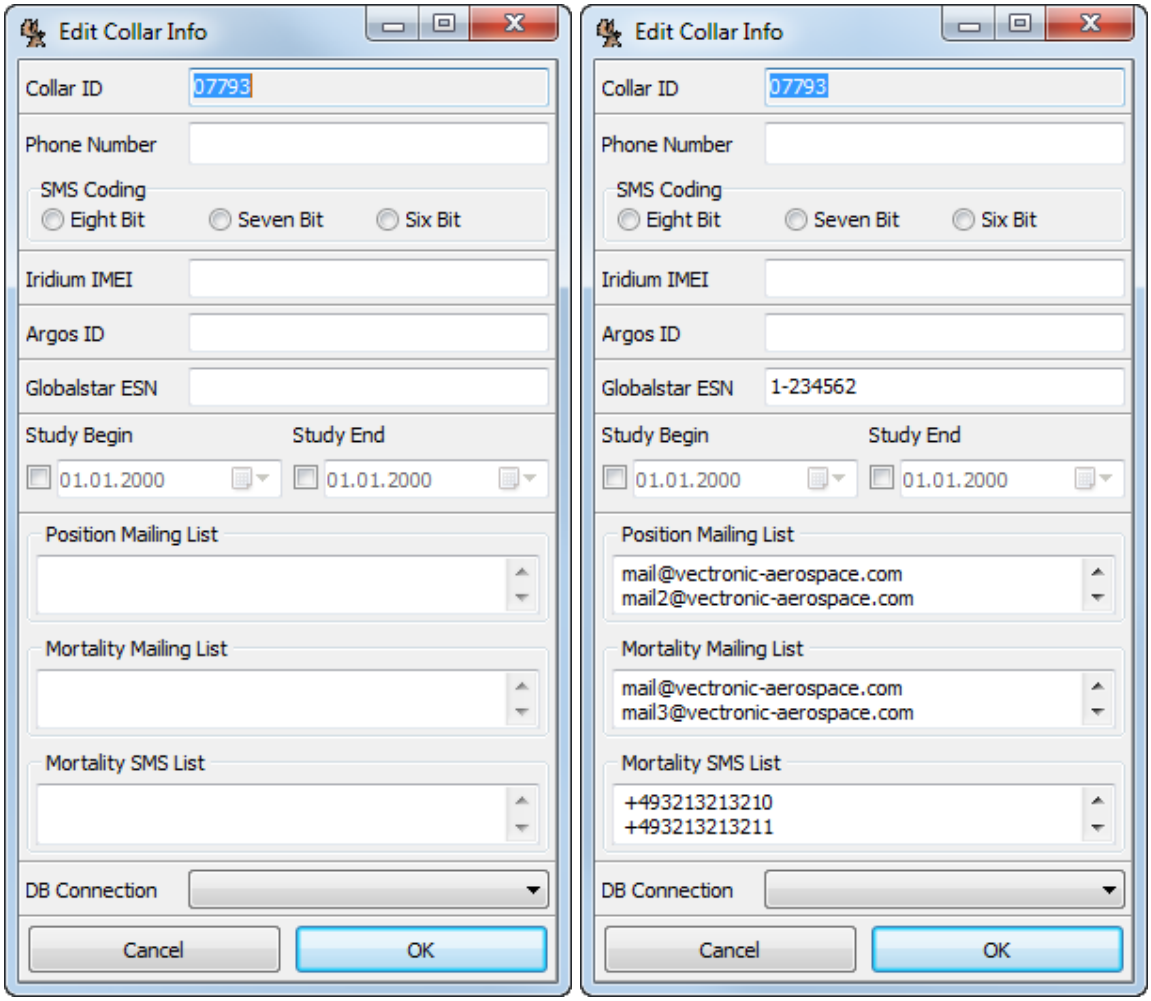

Figure 13: Edit collar info form opened with "Add Collar" (left) and with "Edit Collar" (right)

3.1.7 Database Connections

GPS Plus supports the storage of received data in a database. This database must have a specific format that can be created by the GPS Plus Database Manager and is based on PostgreSQL with the PostGIS spatial extension. You can assign a database connection to a collar in the collar list.

To add a database connection enter the parameters in the dialogue and click on Add. To change parameters of a database select it in the list on the left, edit the parameters and then apply the changes with Apply. To delete the currently selected connection from the list click Delete. To revert any changes on the currently selected connection click Revert.

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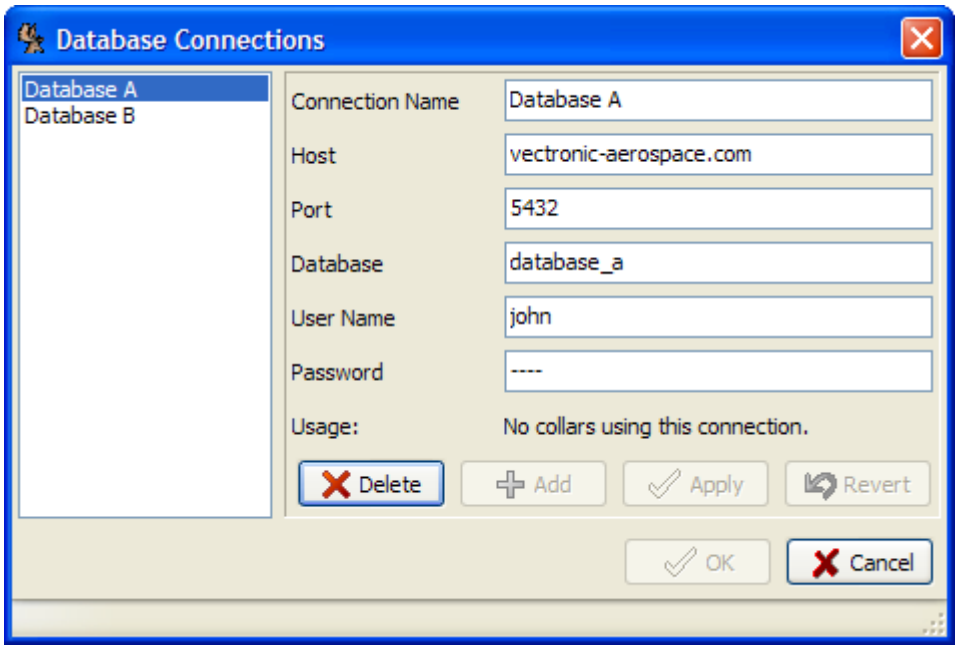

Figure 14: Database connections dialogue with two connections defined

Any changes will be applied only if the dialogue is closed with OK. Closing it with the Cancel button, pressing the escape key, or closing the window with white on red cross in the dialogues window top will discard any changes.

All parameters but the connection name are needed for connecting to the database. In detail they have the following meaning:

Connection Name: This is the name by which the connection is referenced in GPS Plus. If you want data from one collar to go to "Database_A" then you need to associate "Database A" to it in the collar list. **Be aware that if changing the Connection Name, collars configured to this name will not be reconfigured automatically, but will not use any database.**

Host: This is the host name (TCP) or IP address of the computer on which the database server is running. If your database is running on the same computer as GPS Plus, you can enter "localhost".

Port: This is the TCP/IP port number on which the database is listening on the server computer. Since only PostgreSQL is supported, it will be 5432 in most cases.

Database: The name of the database on the database server. Since a database server can host multiple databases, you have to select the one you want to connect to.

User Name: You need to login to the database server. You have to identify yourself with your user name.

Password: This is also part of the login process to the database. You have to authenticate your user name with your password.

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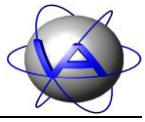

Below the parameters is an information labelled Usage. It shows how many collars are using this connection.

3.1.8 Options

The options form contains all user changeable options of the GPS Plus program. It consists of a page control with six tab sheets: SMS Handling, Mail Server, Mail Message, Export, Geo Transformation, and Misc:

SMS Handling contains options on how to handle incoming and outgoing SMS messages

Mail Server contains information about the mail configuration

Iridium Server contains information about the Iridium service mail configuration

Globalstar contains information about the Globalstar service ftp configuration

Argos defines access information of the Argos telnet server and handling options for positions received via Argos

Mail Message defines the body of outgoing emails

Export I allows you to configure general exporting options, KML (Google Earth), and TCP/IP

Export II allows you to configure the format when exporting to ASCII, Spreadsheet, and Database

Geo Transformation defines the coordinate transformation for exporting of GPS data

Misc contains miscellaneous program options such as UTC correction, GSM PIN, Base Data Path, and autoread configuration

3.1.8.1 SMS Handling Tab Sheet

In the SMS Handling tab sheet, you can configure the program behaviour regarding reception, storage, and export of SMS messages. The program handles SMS messages coming directly from a GSM modem different than such received by email. Therefore, it has two group boxes, one for each type, for configuration and one group box with an option applying for both types.

GSM: Merge SMS messages automatically: Enabling this option will merge any collar SMS message received by GSM (regardless if it has been received in autoread mode or not) with all other SMS messages of the same collar stored as a file to an automatically created file. The file name will be "GSMxxxxx.GDF" where xxxxx is the collar ID. All SMS message files stored in the SMS directory of this collar will be merged and their data sorted chronologically. The resulting file will be stored in the GPS Data directory based on the base data path (see Misc tab sheet).

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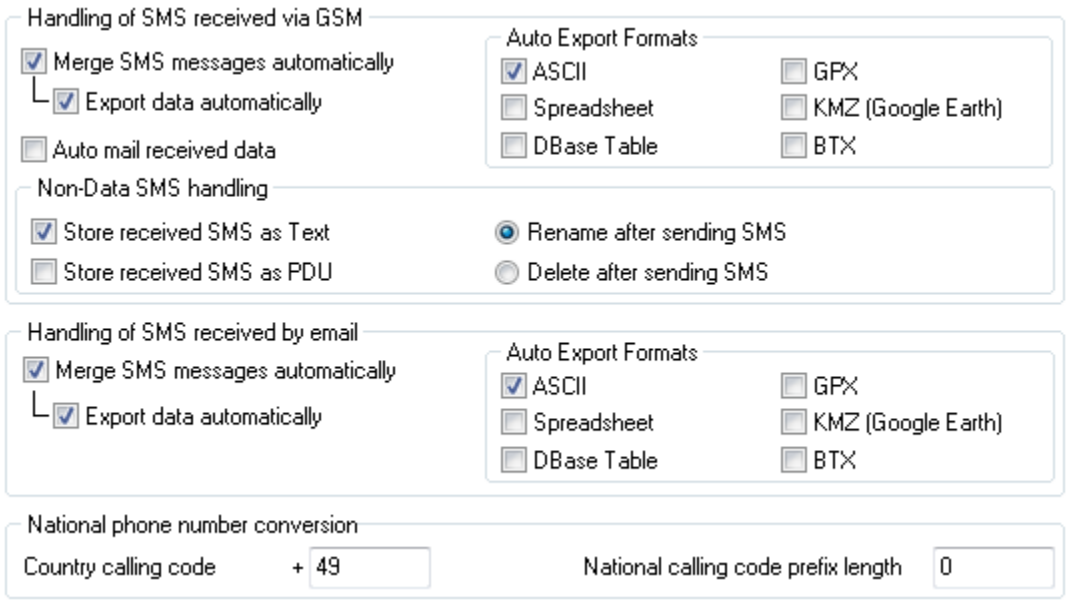

Figure 15: Options form with SMS Handling Tab Sheet

GSM: Export data automatically: This option can only be activated if the proceeding merge option is enabled. The file resulting from the merge option will be exported to a file (name and path are the same as the merged file, only the extension changes) containing an ASCII table, a Spreadsheet file, or a database table in DBase format depending on the selection made in Export Format. To configure the export options, see Export Tab Sheet below.

GSM: Export Format: This option can only be activated if the proceeding merge option is enabled. It defines which export format is used, if the Export data automatically option is selected. The file resulting from the merge option will be exported to a file with the same name and path as the merged file, but different file extensions and formats depending on the following selection.

GSM: Auto mail received data: A received position data SMS from a collar or position data received via Iridium email will be emailed as SMS file, if an address is given in the collars position mailing list. A received mortality data event will be appended to the GSM mortality file of that collar and this text file will be mailed, if an address is given in the collars mortality mailing list. For configuring mailing lists see 3.1.6 Collar List.

```
OA=0193010
SCTS=04/04/15,17:02:52+08
Line_1=Your SMS sent on 15.04.2004 at 17:02 could not be delivered.
```

Figure 16: SMS stored as text

GSM: Store received SMS as Text: Any SMS message that cannot be identified as a collar SMS message will be stored as a text file, if this box is checked, containing the following information: Originating Address, Service Centre Time Stamp, and the text. The format is similar to an INI-file.

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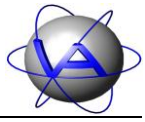

GSM: Store received SMS as PDU: Any SMS message that cannot be identified as a collar SMS message will be stored as a PDU file with the extension .SMS, if this box is checked. The format is the same as the files from the GSM modem in PDU mode.

GSM: Rename after sending: The extension of every sent SMS message will be renamed, if this radio button is selected. There are two types of extensions: .TSM and .PSM. On success they will be renamed to .~TS and .~PS respectively. On failure, the extensions will be .!TS and .!PS.

GSM: Delete after sending: The file of any SMS message that has been sent will be deleted, if this radio button is selected.

Email: Merge SMS messages automatically: Enabling this option will merge any collar SMS message received by email (regardless if it has been received in autoread mode or not) with all other SMS messages of the same collar stored as a file to an automatically created file. The file name will be "GSMxxxxx.GDF" where xxxxx is the collar ID. All in the SMS directory existing SMS message files of this collar will be merged and their data sorted chronologically. The resulting file will be stored in the GPS Data directory based on the base data path (see Misc tab sheet).

Email: Export data automatically: This option can only be activated if the proceeding merge option is enabled. The file resulting from the merge option will be exported to a file with the same name and path as the merged file, but different file extensions and formats depending on the following selection. To configure the export options, see Export Tab Sheet below.

Country Calling Code: The international country calling code of your collars. In some rare cases SMS messages use national phone number coding rather than international. In these cases the phone number has to be transformed to be identified by removing the national calling code prefix and adding the international calling code for the country the collars GSM SIM card is coming from.

National calling code prefix length: The number of national calling code prefix digits of your collars. In some rare cases SMS messages use national phone number coding rather than international. In these cases the phone number has to be transformed to be identified by removing the national calling code prefix and adding the international calling code for the country the collars GSM SIM card is coming from.

3.1.8.2 Mail Server Tab Sheet

This tab sheet contains information about both outgoing and incoming mail server used to send received position messages via email and to receive emails containing SMS messages.

The data will be mailed in Autoread Mode or if the user reads the messages manually.

The Outgoing Mail Server options are only used, if the Auto Mail Received Data checkbox on the SMS Handling tab sheet is checked, while the Incoming Mail Server will only be active if the Mail Reception Subsystem is registered and Enable SMS EMail Reception is checked.

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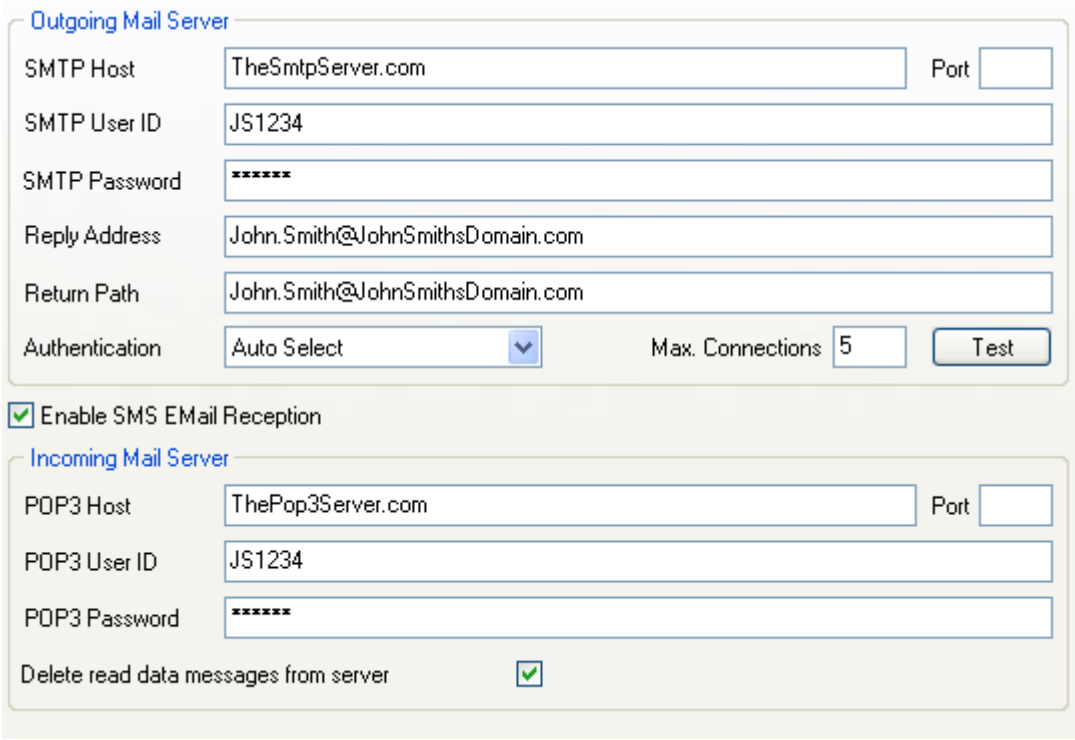

Figure 17: Mail Server tab sheet with dummy data as example

SMTP Host : Name of your SMTP Host

SMTP Port: May be left blank since most SMTP hosts use the default port; only few will use a different port.

SMTP User ID and SMTP Password: applies only for hosts that require SMTP Authentication. If your Internet Service Provider does not use authentication, leave this fields empty. SMTP Password will display an asterisk for every character typed in it.

The Reply Address field should contain a valid email address, where the recipient can reply to and get in contact with you. It is not necessary to enter an address here but it is strongly recommended.

The Return Path should contain a valid email address that will be used to send an error report to if an error occurs on mail delivery. It is not necessary to enter an address here, but it is strongly recommended.

Authentication defines the method of authentication used for the SMTP server by GPS Plus.

With Max Connections you can adjust the maximum number of concurrent connections to your SMTP Server. When reading data from Argos the number of positions coming in is quite large. GPS Plus will open several connections to increase the speed of outgoing emails, but some providers limit the number of possible concurrent connections.

Test: To test the SMTP connection a form has been included in GPS Plus. Click on Test to open this form (see Figure 18).

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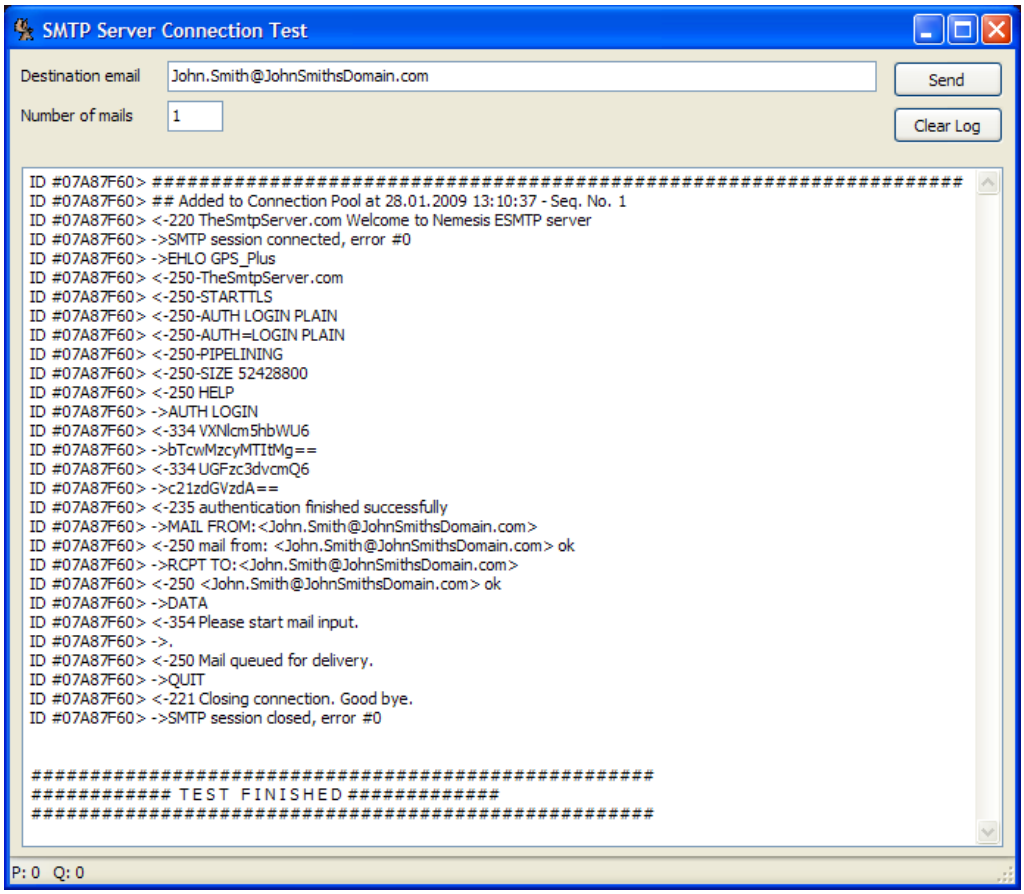

Figure 18: SMTP test form

Enable SMS Email Reception: Activates the reception of emails sent by a GPS Plus application. This is necessary to use GPS Plus and Iridium email reception separately.

POP3 Host: Name of your POP3

POP3 Port May be left blank since most POP3 Hosts use the default port (110); only few will use a different port.

POP3 User ID and POP3 Password are used for the user identification and authentication. POP3 Password will display an asterisk for every character typed in it.

If Delete read data messages from server is checked, every email that is identified to contain collar data will be removed from the POP3 email server after it has been read and stored.

For all fields applies: Ask your system administrator, Internet service provider, or your email provider if you are not sure what to enter or if problems occur. For information about errors, read the file `MailError.Log` in the SMS subdirectory of the GPS Plus directory. Any errors regarding the mailing system of GPS Plus will be logged here in detail.

SMTP Test Form

The only purpose of this form is testing the SMTP functionally by sending emails to a given address. You have to enter a easily checkable and definitely working email address in the destination email field and the number of emails to be send. For the first test, start with one

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email. After clicking on Send you can view how many mails are being processed ('P') and how many are still queued ('Q') in the status bar. When a mail transmission has finished or terminated a log of the communication between GPS Plus ('→') and the SMTP server, ('←') will be added to the form (see Figure 18). If the email does not arrive at the given address, this log contains valuable information on where the problem might be.

3.1.8.3 Iridium Server Tab Sheet

This service is only available for Value Added Resellers. For other VECTRONIC customers, data are forwarded as email by VECTRONIC Aerospace.

This tab sheet contains information on incoming mail server used to receive position messages via email from the Iridium Service.

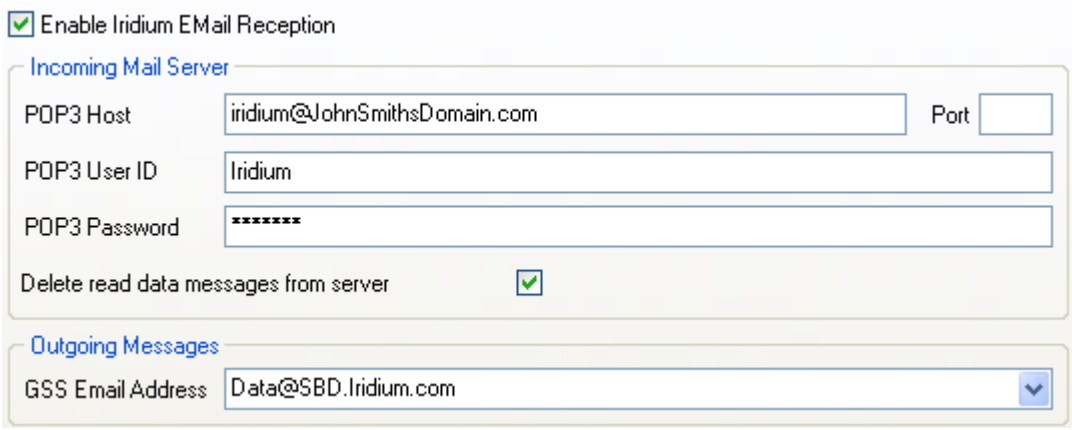

Figure 19: Iridium tab sheet

The Incoming Mail Server will only be active if the Mail Reception Subsystem is registered and Enable Iridium Email Reception is checked.

Enable Iridium Email Reception: Activates the reception of emails sent by The Iridium Service; this is necessary to separately use GPS Plus and Iridium email reception.

POP3 Host: Name of your POP3 Host which receives the Iridium emails in the field.

POP3 Port: May be left blank since most POP3 Hosts use the default port (110); only few will use a different port.

POP3 User ID and POP3 Password are used for the user identification and authentication. POP3 Password will display an asterisk for every character typed in it.

If Delete read data messages from server is checked, every email will be removed from the POP3 email server after it has been read and stored. Unidentified emails will also be removed

For all fields applies: Ask your system administrator, Internet service provider, or your email provider if you are not sure what to enter or if problems occur. For information about errors, read the file `MailError.Log` in the SMS subdirectory of the GPS Plus directory. Any errors regarding the mailing system of GPS Plus will be logged here in detail.

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3.1.8.4 Globalstar Tab Sheet

This service is only available for Value Added Resellers. For other VECTRONIC customers, data are forwarded as email by VECTRONIC Aerospace.

This tab sheet contains configuration data for the FTP connection to the server where the Globalstar data files are being delivered to.

Figure 20: Globalstar tab sheet

FTP Host: Enter the name of your Globalstar FTP server. You can either enter a host name or a IP address.

Port: Enter the port of your Globalstar FTP server. If you do not enter anything the default will be used (21).

FTP User ID: Enter the user name needed to access the Globalstar FTP server.

FTP Password: Enter the password to your Globalstar FTP server user name.

Delete read data files from server: If this option is checked, every file will be removed from the FTP server after it has been read and stored. Unidentified emails will also be removed.

3.1.8.5 Argos Tab Sheet

This tab sheet contains configuration data for Argos data reception.

Telnet Host: Enter the name of your Argos telnet server. You can either select one from the drop down list or enter a name manually.

Telnet Port: Enter the port of your Argos telnet server. By default this should be 23 (telnet port).

Argos Username: Enter the username needed to access the Argos telnet server. You can obtain this from Argos when you request an Argos account.

Argos Password: Enter the password to your Argos telnet server username. You can obtain this from Argos when you request an Argos account.

Store Argos positions: When selected, GPS Plus will not only store positions taken by the GPS module of Argos collars but also those positions determined by Argos itself. These positions are not as precise as the GPS positions but could provide valuable supplementary information.

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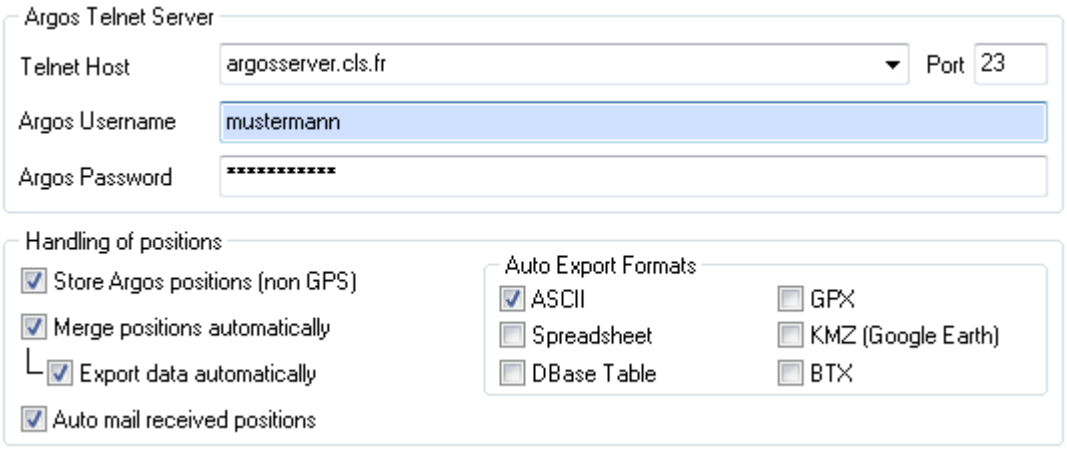

Figure 21: Argos tab sheet

Merge positions automatically: When checked, GPS plus will merge all positions of the received collar, that have been stored until now, to a GDF file. The filename will be `ArgosXXXXX.GDF` where XXXXX stands for the collar ID. If the file already exists it will be overwritten.

Export data automatically: When checked, GPS Plus will export the merged GDF file to an export file of the selected format. The filename will be then same as the GDF file except for the extension, which is depending on the format. If the file already exists it will be overwritten.

Export Format: This defines which export format is used, if the Export data automatically option is selected. XML formats (BTX, KML, GPX) are not supported in this case, because exports in this format can take a long time.

Auto mail received positions: All received positions will be sent as an SMS file by email to the recipients of the collar configured in the collars list.

3.1.8.6 Mail Message Tab Sheet

This tab sheet contains information about the outgoing mail messages. There are two memos in the form: The first, titled Body of position email message, contains the text of the emails with a position data SMS file attached. You can enter any text you want as a description of your emails. The data will be sent as an attachment of the email so this field is the entire message the recipient gets to see in the email body. The second, titled Body of mortality email message, serves the same purpose for mails with a mortality data file attached.

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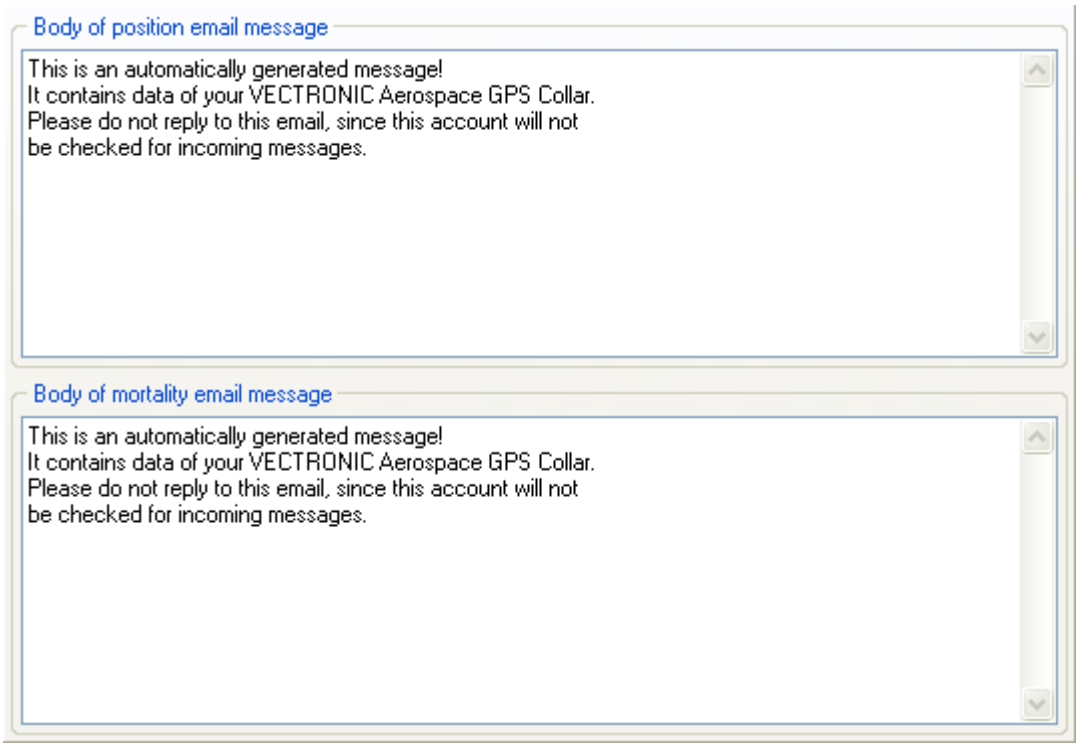
Body of position email message
This is an automatically generated message!
It contains data of your VECTRONIC Aerospace GPS Collar.
Please do not reply to this email, since this account will not
be checked for incoming messages.
Body of mortality email message
This is an automatically generated message!
It contains data of your VECTRONIC Aerospace GPS Collar.
Please do not reply to this email, since this account will not
be checked for incoming messages.

Figure 22: Mail Message tab sheet

3.1.8.7 Export I Tab Sheet

This tab sheet contains several options regarding the configuration of exports.

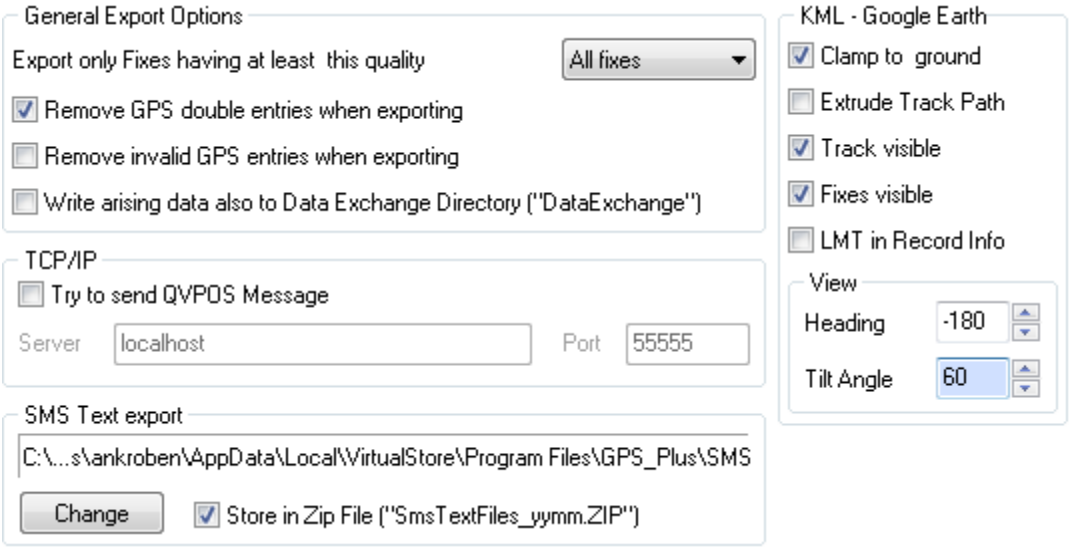

Figure 23 : Export I tab sheet containing general export configurations

Export fixes quality: This option allows you to select the quality of fixes that are taken into account when an export is done. The following levels are available, worst quality first, better quality is always included: All fixes, Argos Z, Argos B, Argos A, Argos 0, Argos 1, Argos 2, Argos 3, GPS 2D, GPS 3D, Validated. Default setting is All Fixes.

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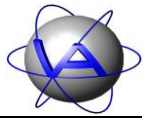

Remove double entries: If checked, position double entries in GDF files will be removed from the exported data.

Remove invalid entries: If checked, invalid positions in the GDF files will be removed from the exported data.

Write to data exchange: If checked, all incoming data will be written also to the data exchange directory for use by other programs. The data exchange directory's name is "DataExchange" and it is located in the Base Data Path.

TCP/IP: This allows you to send position messages you received over TCP/IP to the given host (server) and port. A NMEA-style position message will be generated and send if this option is selected. The message is a special message used by the TouraTech QV Software to receive and display position data automatically on a map. The message itself has the format shown in Figure 24.

```
$QVPOS,xyz,0,170804,121500,50.55947,7.11563,50.1,180,1234*64

Field Number, fields separated by COMMA:
0) $QVPOS
1) Sender ID String, Name of sender, if present,
will be used as Sender_ID in QV
2) Status Number, currently always 0
3) UTC Date ddmmyy
4) UTC Time hhmmss.s
5) Latitude decimal wgs84, south is negative
6) Longitude decimal wgs84, west is negative
7) Speed km/h
8) True course, Degree
9) Altitude Meter
10) XX NMEA-Checksum
```

Figure 24: Description of QVPOS message

KML – Clamp to ground: If checked, the path displayed in Google Earth is always shown as anchored to the ground, regardless of its altitude or if terrain is enabled or not.

KML – Extrude Path: If checked, the path will be shown as an semi-transparent wall with height of the fixes altitude.

KML – Track visible: If checked, the track will be visible in Google Earth as coloured line.

KML – Fix visible: If checked, all fixes will be visible in Google Earth as coloured icons.

KML - LMT in Record Info: If checked, the local mean time according to the UTC correction of GPS Plus will be shown in Google Earth.

KML – View: Here, you can adjust the initial viewing direction when you load your exported data into google earth. Heading adjusts the angle from north. North is zero, east +90, west –90, and south is –180/+180. Tilt angle is the up/down looking angle: Zero will look down, 90 will look to the horizon.

SMS Text Directory: Here, you can change the directory where the text version of incoming SMS messages will be stored. For further explanation of this feature, please refer to 5.2.1

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Get SMS Messages. You can select any directory shown in the directory tree. To create a new directory, please use the standard windows tools like windows explorer. The directory will be displayed in the bottom field immediately. If you select a drive that is not accessible (e.g. a CD drive without a CD) you will get an error message.

3.1.8.8 Export II Tab Sheet

This tab sheet defines the format of the export files (ASCII, Spreadsheet, or Database) of both GPS and Activity data.

GPS (ASCII, Spreadsheet, and Database) export options allow selecting the data columns that will be exported and their order. To select or unselect a column, click on the checkbox left to it. To change the position, mark it by clicking on it and press the up or down arrow left to the list. Reset to Default selects all items and sorts them in the default order.

ASCII and Spreadsheet also allow including or excluding the table header by checking the Include Header checkbox, and to select a date format from a combo box. In the GPS spreadsheet you can also select the separation character(s) that is used to separate two neighbouring columns. You can select one from the list or enter your own string.

Activity & GSM (ASCII, Spreadsheet, and Database) export options only have the Include Header option and the date format selection since there are too few different data items than to worry about. In the database group box both options apply only for GSM quality datasets which are always stored as ASCII.

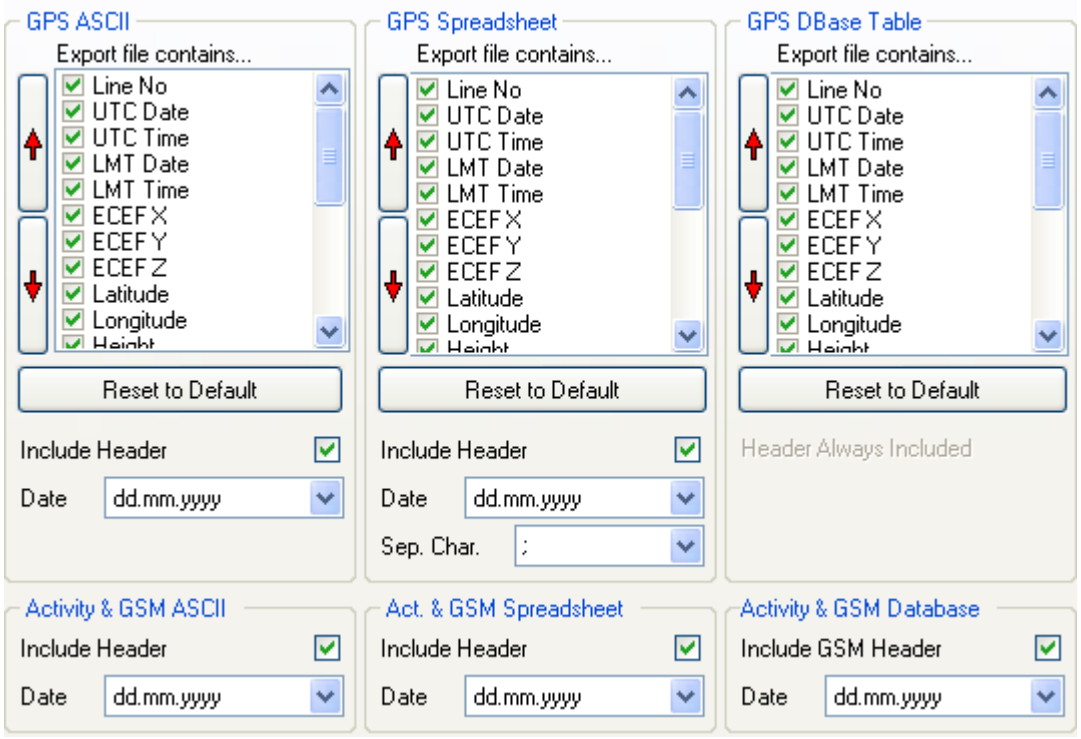

Figure 25: Export II tab sheet containing formatting configuration

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3.1.8.9 Geo Transformation Tab Sheet

This tab sheet allows you to configure a coordinate transformation for the export of GPS position data. You can select a coordinate system and a reference ellipsoid independently. Furthermore, you can define your own coordinate system and/or reference ellipsoid (including geodetic shift). Last but not least, you can test-transform manually entered coordinates.

All this can be done without limitations! However, if you export a GPS Data File (.GDF), only every sixth data set will be transformed unless you purchase the coordinate transformation subsystem. Then all datasets will be transformed.

The GEO Transformation tab sheet consists of a Target System group box in the upper half and a tab sheet group below.

In the group box you can select a country or region. This selection limits the number coordinate systems to those common and valid there. Then you select the destination coordinate system, the Reference System (or reference ellipsoid, and geodetic shift), the meridian strip (only for appropriate coordinate systems as Gauss Krueger, UTM and such), the number of decimal places of the transformed coordinates, and whether or not the program should check if the coordinates are within the limits of the selected coordinate system.

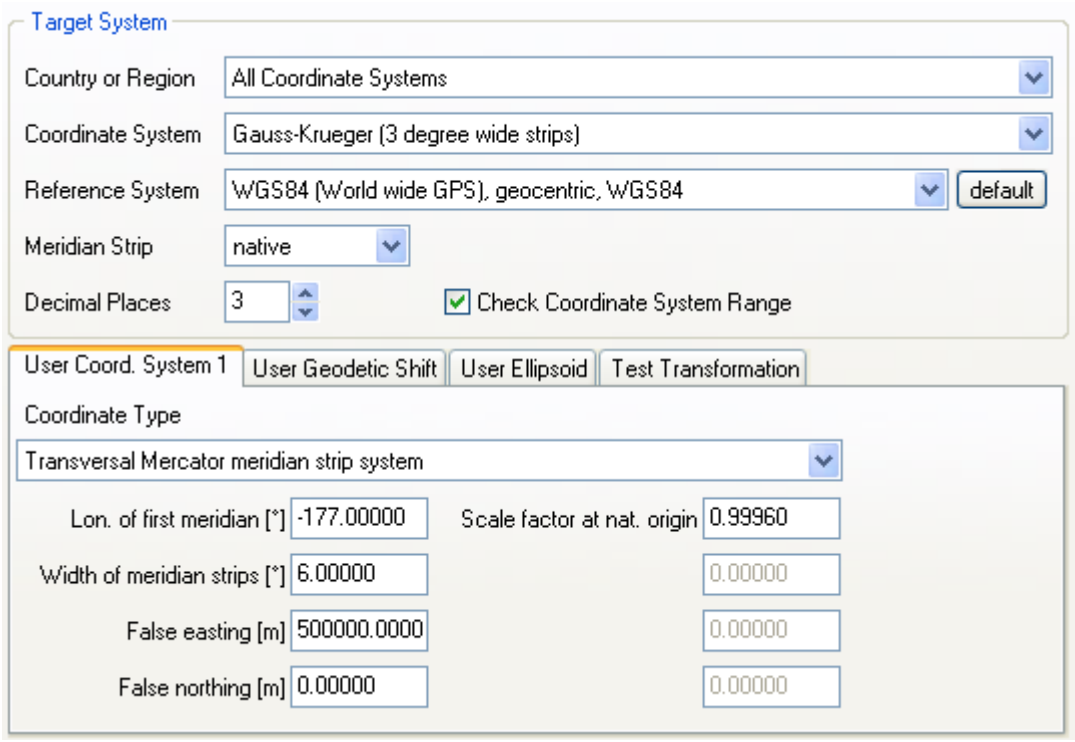

Figure 26: Geo Transformation tab sheet with sub-tab sheet User Coord. System 1 selected

The tab sheet group has four tab sheets: User Coordinate System 1, User Geodetic Shift, User Ellipsoid, and Test Transformation (see Figure 26 to Figure 29). In the User Coordinate System 1, you can define your own coordinate system. This is only recommended for people who really know what they have to enter here. Otherwise, the results may be quite

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unpredictable. The same is true for the User Geodetic Shift and the User Ellipsoid tab sheet. These two are used to define the Ellipsoid upon which the coordinate system is projected.

The originating system for all transformations is Geographic coordinates in degree (as decimal, not degrees and minutes or degrees, minutes and seconds) and WGS 84 as reference ellipsoid.

To test the transformation you have chosen, enter a coordinate pair (longitude and latitude) and transform it to your system. Input has to be in degrees (format: ddd.ddddd). If you move to the target coordinates (on the right) and point for a few seconds on one of the coordinate results, the program will display the format of the output (as described in Appendix F: Available Coordinate Systems).

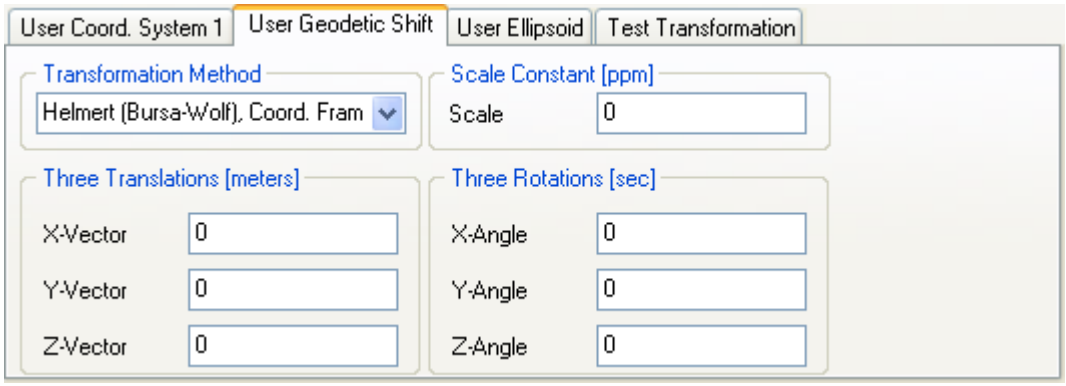

Figure 27: Sub-tab sheet User Geodetic Shift

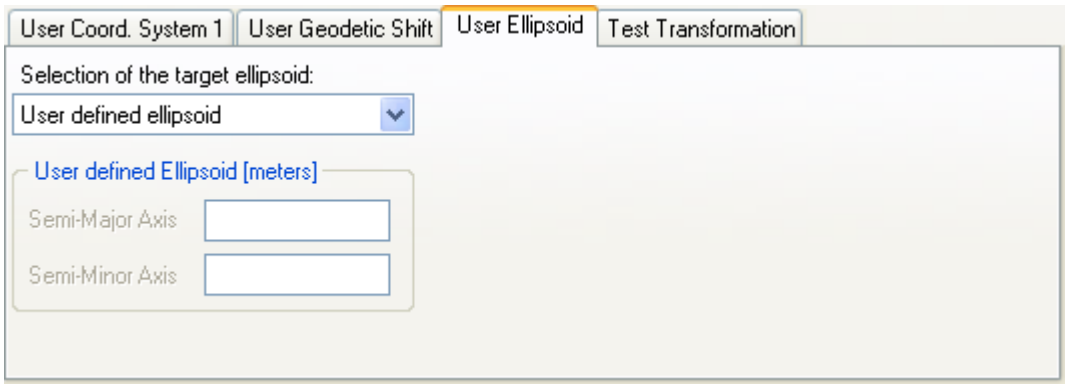

Figure 28: Sub-tab sheet User Ellipsoid

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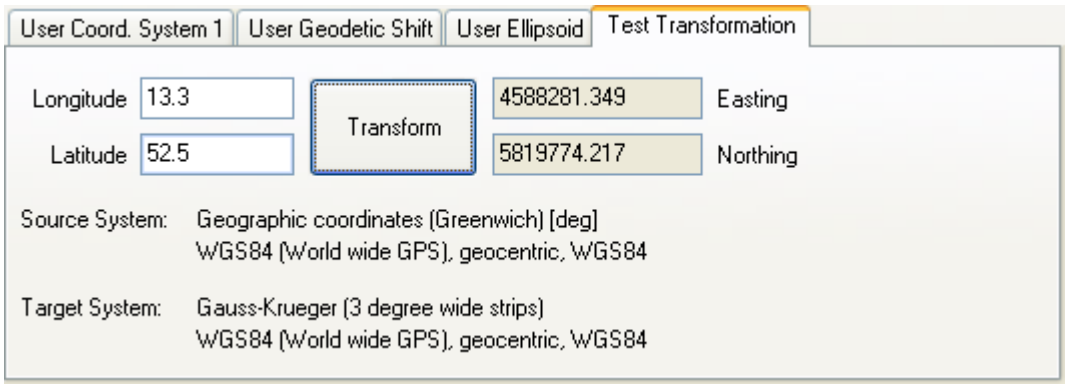

Figure 29: Sub-tab sheet Test Transformation

3.1.8.10 Miscellaneous Tab Sheet

The Miscellaneous tab sheet has five areas (Figure 30): Autoread Options, UTC correction, GSM, Debugging, and Base Data Path.

The first area allows you to control the following options:

The GSM Read Interval [minutes] shows the time between the end of a read GSM action and the start of the next in the GSM autoread mode. The input zero will result in a 30 second delay to prevent permanent reading.

Start Mail Autoread at program start: If checked, the program will automatically start in the autoread mode of the Mail Reception dialog without any actions to be taken by the user. Depending on Iridium and SMS email reception this will receive data via email.

The Mail Read Interval [minutes] shows the time between the end of a read Mail action and the start of the next in the Mail autoread mode. The input zero will result in a 30 second delay to prevent permanent reading.

Start GSM Autoread at program start: If checked, the program will automatically start in the autoread mode of the Get SMS Messages dialog (see 5.2.1 Get SMS Messages) without any actions to be taken by the user.

The Argos Read Interval [minutes] shows the time between the end of a read Argos action and the start of the next in the Argos autoread mode. The input zero will result in a 30 second delay to prevent permanent reading.

Start Argos Autoread at program start: If checked, the program will automatically start in the autoread mode of the Argos telnet dialog without any actions to be taken by the user.

Sound allows you to disable the sounds in the autoread mode. This prevents the computer to beep permanently if a mortality message has been received.

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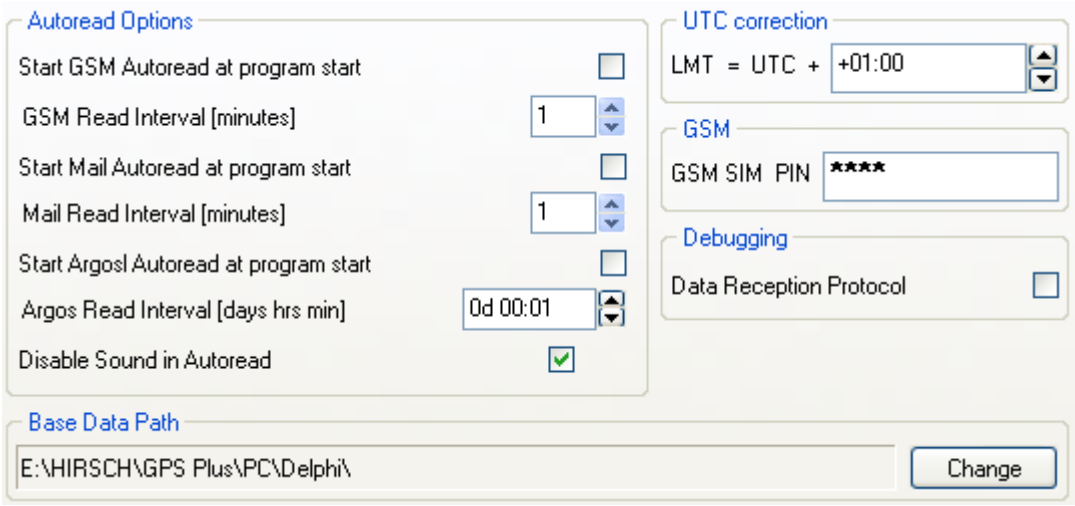

Figure 30: Tab sheet Miscellaneous

With the UTC correction command you can configure your UTC correction. Choose negative values for areas west of Greenwich (e.g. -3 for the east coast of South America or -10 for Alaska) and positive values for areas east of Greenwich. The program does not correct daylight saving time; you will have to adjust it for yourself. For a list of time zones and their LMT - UTC difference see Appendix E: Time zones.

This time difference will only be used when creating GPS or VHF schedules or when exporting or viewing data from files. In the first case, you will be asked to choose between UTC and your LMT. In the second case, data will always be saved in is in UTC, but the export files will show UTC and LMT.

GSM SIM PIN: This field contains the PIN (Personal Identification Number) of the SIM card in the GSM modem used to receive SMS messages. The field will display an asterisk for every character typed in it.

Debugging: This option enables a log file for debugging data reception. Since GSM Providers often differ in small things, we included this option to enable us to help you. If you encounter problems while receiving messages it is a good idea to enable this option and send us the log files.

The Base Data Path gives the path to the data directories used by the program. You can only change it to existing directories. If you change it, the program will create the following subdirectories in this directory (if they do not exist already): Activity Data, GPS Data, Schedule Files, Mortality Files, Keys, SMS, SMS\Inbox, SMS\Outbox. The program will now store its data in these directories. By default the Base Data Path will be the program path.

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3.1.9 Collar, GSM Base Station and Handheld Terminal

Selecting one of these menu items switches into the corresponding mode: Collar allows communicating with a collar connected via a link manager. GSM Base Station enables the commands to operate with a GSM modem and Handheld Terminal enables the communication with the Mobile Handheld Terminal connected either via a link manager or directly via USB.

3.1.10 Play Beacon Sound

If your collar is equipped with a VHF beacon, you can choose from four different beacon patterns. This can help you to distinguish individual collars in the field. The beacon pattern of each collar can be found in the collar information file.

The VHF beacon can also change its pattern in the field under certain circumstances. The two possible beacon patterns you might encounter are:

Emergency Signal	If the battery is low, there will be a double signal of twice 6 ms at the beginning of the 1.5 s interval.
Mortality Signal	If no activity has been detected for a user-defined time span, the signal will switch to the mortality mode: one 6 ms signal per 750 ms (only collars with enabled mortality sensor).

Play Beacon Sound allows you to listen to the beacon patterns on your PC to help you identify them in the field.

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4 Collar Mode

In this mode the program can be used to read data from collars and configure collars. The GPS and activity data can be saved to files and exported, viewed in a data browser, or displayed as a graph.

There are two buttons which are only available in the collar mode:

Show collar status: Opens a window to display the current status of the attached collar. For details refer to 4.4.4 Collar Status.

Show collar telemetry: Read the telemetry of the attached collar. For details refer to 4.4.2 Collar Telemetry.

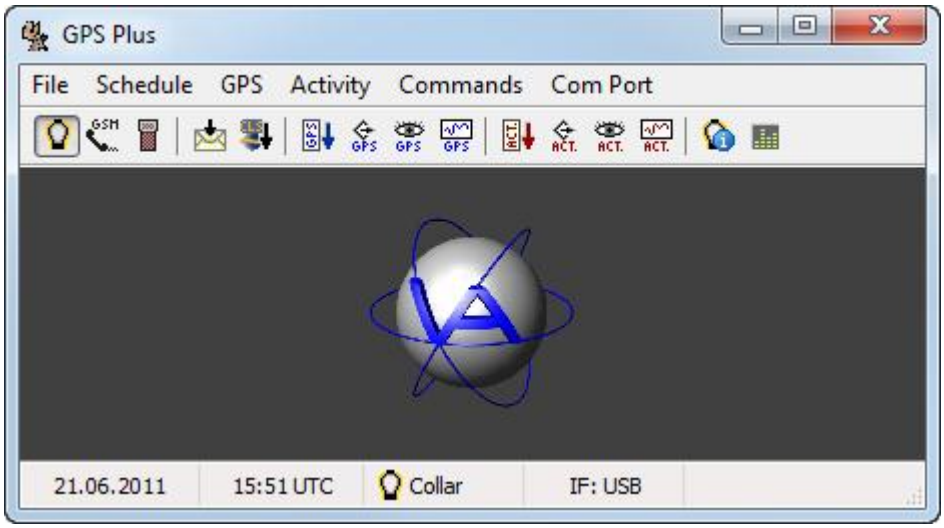

Figure 31: Main window in collar mode

4.1 Schedule Menu

In the *Schedule* menu you find commands concerning GPS measurement, beacon activation, and Argos communication scheduling. The commands allow the creation of GPS, beacon, Argos, and GSM/Iridium schedules, the sending of schedules to a collar and the reception of schedules from a collar.

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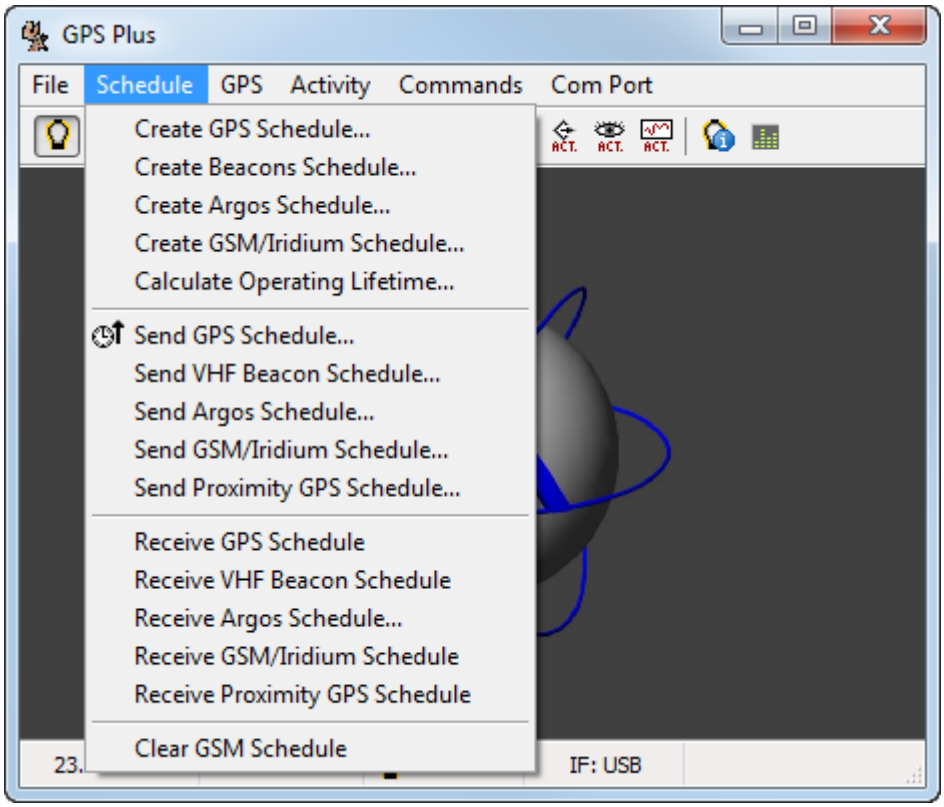

Figure 32: Main window with open schedule menu (in Collar mode)

4.1.1 Create GPS Schedule

The Create GPS Schedule command is used to define rules stating at which times a GPS measurement has to be done. The time used in this scheduler is not defined to be UTC (Universal Time Coordinated) or any other LMT (Local Mean Time). The selection of UTC or LMT is done with the UTC correction inside the collar (Collar Mode: Commands ⇨ Collar Configuration ⇨ UTC Correction, refer to 4.4.3.1 Time – UTC Correction). Please check that the programmed times and the UTC correction correspond to obtain the correct times for GPS measurements.

As you can see in Figure 33 the scheduler has a menu, a toolbar with buttons and an area displaying a list containing the defined rules. In the example, there are already four rules defined.

4.1.1.1 Clearing, Loading, and Saving a Schedule

These commands can all be reached via the tool bar or the main menu. They are valid for all schedules in the Schedule menu.

To clear the current scheduler, click on the clear button or select Clear Schedule from the file menu. This will erase all rules and clear the file name. All changes made to the schedule will be lost.

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To load a schedule, simply click on the open button or select Load Schedule... from the file menu. An open file dialog will open in which you can select an appropriate schedule file.

To save a schedule, click on the save button or select Save Schedule from the File menu. This will save the current schedule to the current file name given in the title bar of the form. If no file name is specified so far, a save file dialog will open and you can enter a new name.

To save the current schedule to a new name click on the save as button or select Save Schedule as... from the file menu. A save file dialog will open and you can enter a new name.

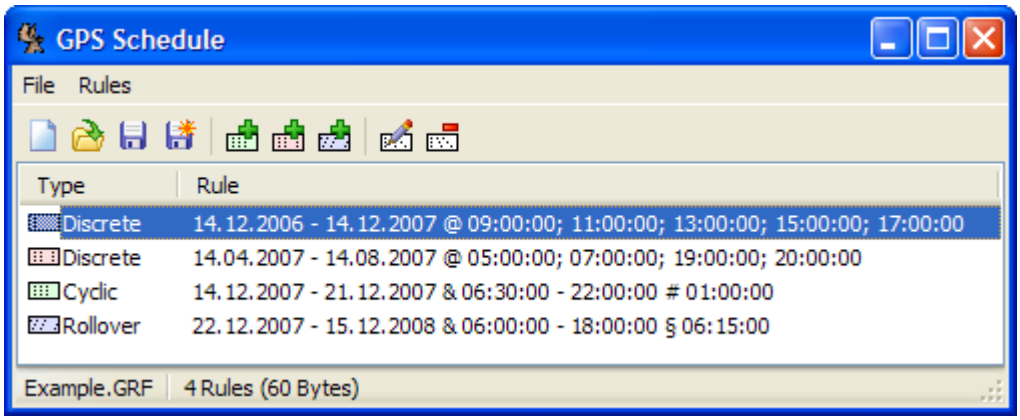

Figure 33: Schedule with all three rules

4.1.1.2 Adding a rule

There are three rule types: Cyclic, Discrete, and Rollover. To add a rule you click on one of the buttons with the green plus sign: The green button adds a cyclic rule, the red button a discrete rule, and the purple button a rollover rule. After defining a rule, use OK to adds the rule or Cancel to discard it.

The *Cyclic Rule* defines a period of time with a start date and an end date between which measurements will be done every day in a selected frequency. Enter the start and end day of the period and the time of start and end on each day within this period. Then select the frequency of GPS measurements (*Cycle Frequency*). The first measurement will be taken at the exact start date and time (in our example 06:30 on the 14.12.2007, Figure 34). The second measurement will take place at the start time plus the cycle frequency (here 07:30 on the 14.12.2007). The end time is not necessarily the time of the last measurement of the day. In our example the last measurement would be at 21:30 on 21.12.2007.

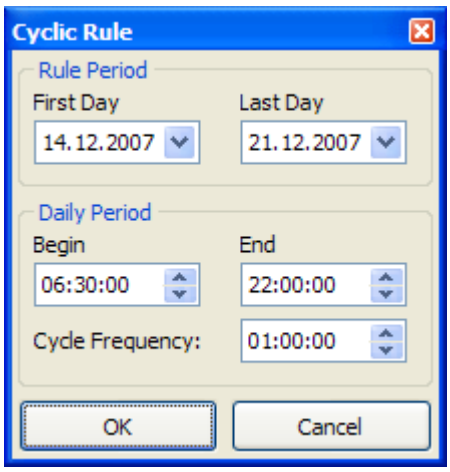

Figure 34: Cyclic rule edit form

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The *Discrete Rule* defines a period of time with a start date and an end date in which several discrete times per day can be defined for measurement. Enter the start and end day of the period (see Figure 35). Then enter the discrete times of measurement (in our example 09:00, 11:00, 13:00, 15:00, and 17:00) and press Add Time to add them to the list. Select a time from the list and press Remove Time to discard it. The measurements will take place at exactly these times on every day of your selected rule period.

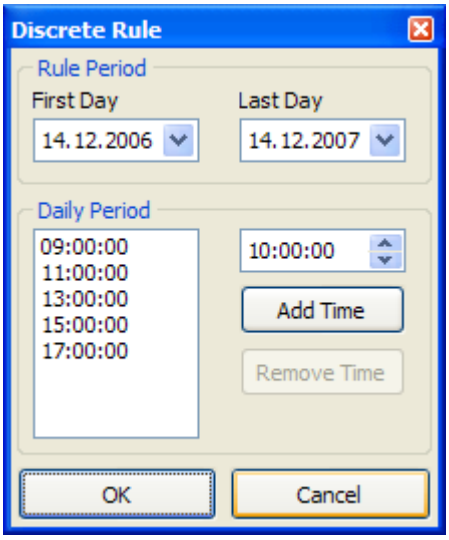

Figure 35: Discrete rule edit form

The *Rollover Rule* does not work on a day-by-day basis like the other two rules. It defines a start mark with date and time (*First Day*, in our example, Figure 36, 06:00 on the 22.10.2007), an end mark (*Last Day*, here 15.12.2007) and again a *Cycle Frequency*. The measurement starts on the first day at the selected time and is repeated with the cycle frequency (here 6 hours, 15 minutes) until the end mark. This way, the measurements do not necessarily take place every day at the same time and are independent from single days. You can enter any frequency from one minute to 36 hours 24 minutes and 30 seconds in two seconds steps. Date and time are adjusted the same way as described in the other rules.

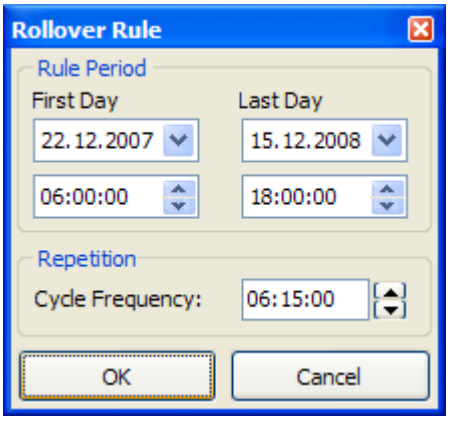

Figure 36: Rollover rule edit form

Rollover rules are only supported by collars with a firmware version of 1.7.1 or higher. The firmware can only be validated if you have the collar connected directly via the link manager and not via VHF/UHF (Handheld Terminal) or SMS (GSM Base Station). If you program a schedule containing a rollover rule to a collar not supporting this rule type, the rollover rule will be ignored and your schedule might be useless to your needs.

If the Start Date of all Time Rules is more than one week in the future, the collar will make a fix automatically every week until the first Start Date. This is a safety measure in case that the collar clock was not properly set and to allow the collar to recalibrate its internal clock at the latest of one week. When all End Dates of all rules are outdated, the collar will make a fix every six hours. To prevent this safety measure if you want to have a longer period with no fixes, one rule should start well in the future.

If no positions are taken, no GSM, Globalstar or Iridium communication will be opened. This means that no new commands or schedules can be transmitted to the collar!

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4.1.1.3 Editing and Erasing a Rule

To **edit** a rule you can either double click on it, select a rule and click on the edit rule button, or select a rule and select Edit Rule... from the Rules menu. The appropriate edit form (discrete, cyclic, or rollover) will automatically be selected. Edit the rule to your needs and close it with OK to apply the changes or with Cancel to discards them.

To **erase** a rule, you can either select a rule and click on the erase rule button or select a rule and select "Erase Rule…" from the Rules menu. The erase rule command supports the selection of multiple rules: By holding the Shift key while clicking on a rule you can select a range of rules and by holding Ctrl you can add individual rules to your selection.

4.1.2 Create Beacon Schedule

This command is used to create schedules for the VHF beacon. It is similar to the Create GPS Schedule, but only allow cyclic rules with no frequency are allowed, so there is only one command to add a rule. The frequency shown in the rules list is always zero, since the beacon will be on the entire time span (see Figure 34). The beacon pattern can be configured in 4.4.3.6 VHF Beacon Pattern. When all End Dates of the VHF scheduler are outdated, the VHF beacon is switched **off**.

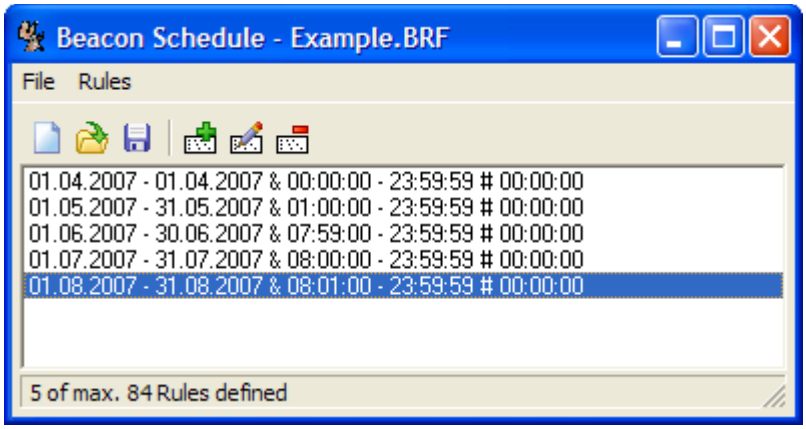

Figure 37: Beacon Scheduler with five rules in the list

4.1.3 Create Argos Schedule

The Argos schedule is a two levelled schedule: the first level defines periods and a loop duration per period and the second level defines transmission times in a loop of a period. This scheme is clearly visible in the layout of the form (see Figure 38). The periods are shown in the upper list while the On Times of the currently selected period are in the lower list. Below the On Time list is a graphical illustration of the selected Period's loop.

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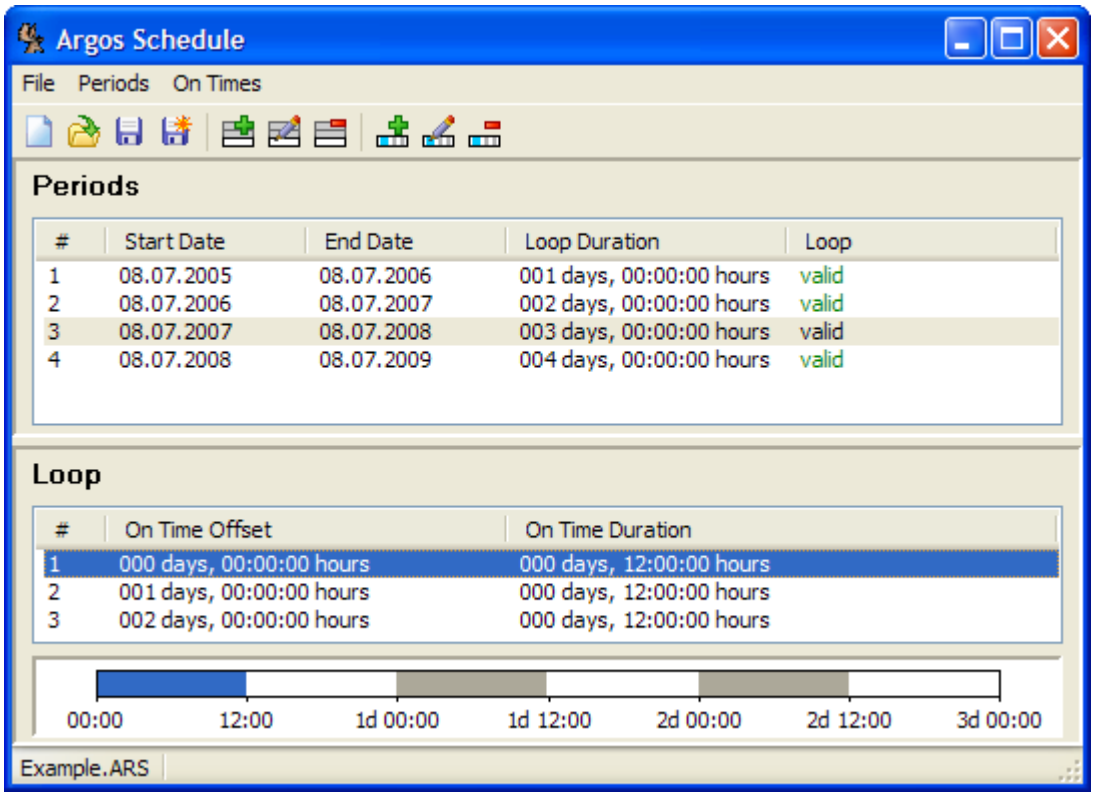
Argos Schedule
File Periods On Times
Periods
Start Date End Date Loop Duration Loop
1 08.07.2005 08.07.2006 001 days, 00:00:00 hours valid
2 08.07.2006 08.07.2007 002 days, 00:00:00 hours valid
3 08.07.2007 08.07.2008 003 days, 00:00:00 hours valid
4 08.07.2008 08.07.2009 004 days, 00:00:00 hours valid
Loop
On Time Offset On Time Duration
1 000 days, 00:00:00 hours 000 days, 12:00:00 hours
2 001 days, 00:00:00 hours 000 days, 12:00:00 hours
3 002 days, 00:00:00 hours 000 days, 12:00:00 hours
00:00 12:00 1d 00:00 1d 12:00 2d 00:00 2d 12:00 3d 00:00
Example.ARS

Figure 38: Argos Schedule editor with example schedule loaded

4.1.3.1 Adding a Period

To add a period, click on the Add Period toolbar button or select Add Period... from the Periods menu. A dialog (Figure 39) will open, where you can enter the periods data.

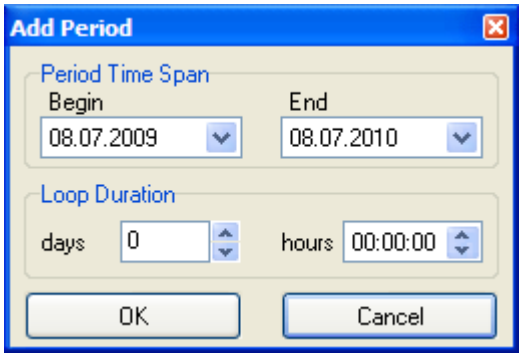

Figure 39: Add Period dialog

Set the Begin and End dates of the periods time span to define the desired period. Begin will be at 00:00:00 UTC of the selected begin date and End will be at 00:00:00 (UTC) of the selected date. Then select the duration of the loop: This is the repetition Loop Duration, in which the transmission will be defined and repeated. The duration is given in days and hours, minutes, and seconds to provide maximum flexibility in defining transmissions.

4.1.3.2 Editing a Period

To edit an existing period, click on the Edit Period toolbar button or select Edit Period... from the *Periods* menu. Before the edit dialog opens, which is similar to the *Add Period* dialog, a warning will be displayed:

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WARNING: This will erase the corresponding loop information to prevent inconsistencies within the loop. Do you really want to do this?

If you choose to continue you will lose the loop information of the period you will be editing.

4.1.3.3 Removing a Period

To remove a period click on the Remove Period toolbar button or select Remove Period from the *Periods* menu. After a confirmation request the currently selected period will be remove from the list. The corresponding loop information will of course also be removed.

4.1.3.4 Adding an On Time to a loop

To add an On Time click on the Add On Time toolbar button or select Add On Time... from the *On Times* menu. A dialog (see Figure 40) will open, where you can enter the On Time's data. There is a Start Offset and a Duration. Transmission begins at the time given in the start offset after loop start. It will be active for the time given in Duration.

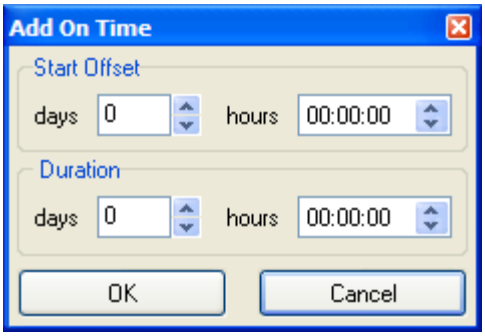

Figure 40: Add On Time dialog

4.1.3.5 Editing an On-Time

To edit an On Time, click on the Edit On Time toolbar button or select Edit On Time... from the *On Times* menu. A dialog will open, similar to the *Add On Time* dialog.

4.1.3.6 Removing an On-Time from a loop

To remove an On Time click on the Remove On Time toolbar button or select Remove On Time... from the *On Times* menu. The selected On Time will immediately be removed. There will be no further requests.

4.1.4 Create GSM/Iridium Schedule

This command is used to create schedules for GSM/Iridium communication. It is similar to the Create GPS Schedule command with some small differences: GSM/Iridium schedules have only one rule type, which is similar to the GPS rollover rule: It defines a Start mark and an End mark (date and time) in which GSM/Iridium transmissions are attempted at a frequency defined by the period in the rule (see Figure 41). A maximum of 13 such rules can be defined in one GSM/Iridium schedule.

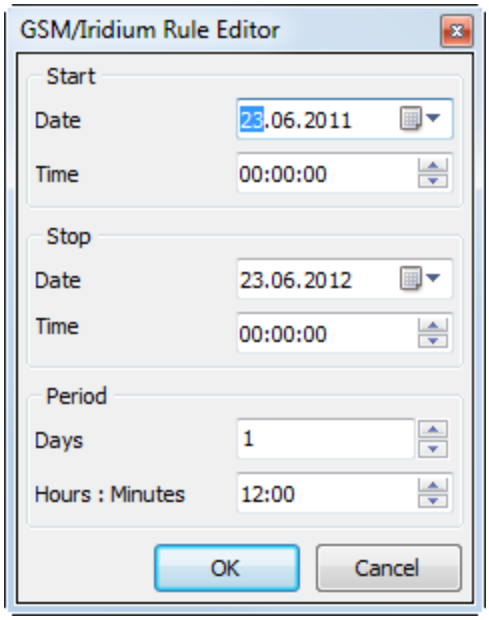

Figure 41: GSM/Iridium Rule dialog

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4.1.5 Lifetime Calculation

This command estimates the battery lifetime of a collar. You have to select a collar and a battery type, some collar options, and the schedules for GPS measurements, VHF Beacon, and Argos transmissions, where the last three are optional. From these inputs the program calculates a best, average and worst case battery life time estimates. Best case assumes that the GPS receiver needs 45 seconds in average over the whole lifetime; Average assumes this time to be 90 seconds and worst case uses 180 seconds.

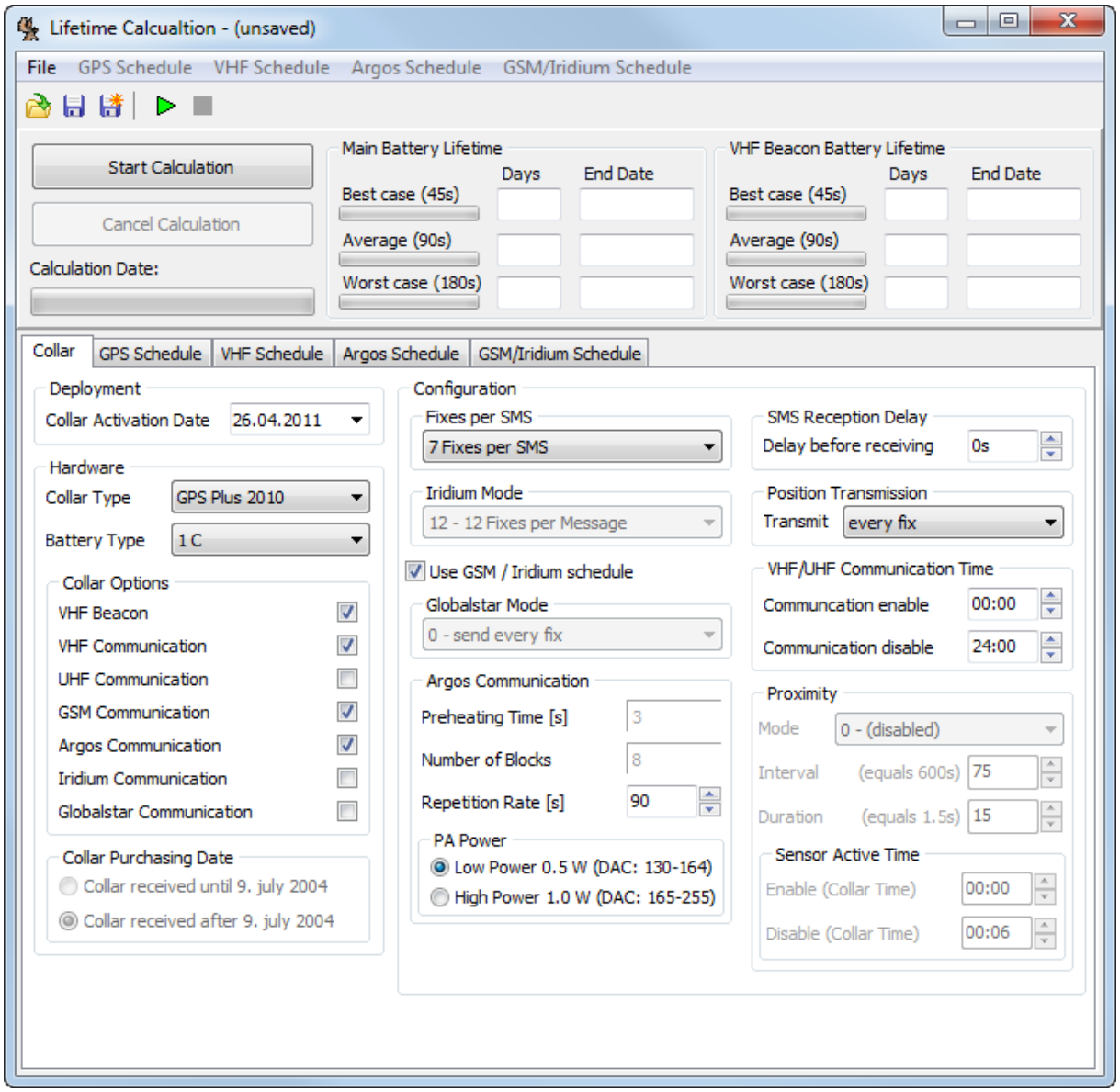

Figure 42: Collar Lifetime Calculation form

On command start-up the form will look like Figure 42. In the upper part you can see the Start Calculation and the Stop Calculation button, the calculation progress, and the resulting Battery lifetimes. In the battery lifetimes there are charge indicators (like progress bars) for every case and battery showing the charge while the calculation is done.

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In the lower part of the form there are several tab sheets, where the calculation is configured: The first tab sheet contains collar specific data. The other tab sheets contain schedules for GPS, VHF beacon, and Argos.

4.1.5.1 Collar Tab Sheet

There are three groups in this tab sheet: Deployment, Hardware and Configuration.

To calculate the lifetime of the batteries you first have to select the general settings on the left: Under Deployment, select a Collar Activation Date. This can be the actual date you plan to deploy the collar or any date that is a good start date for the calculation.

Under Hardware, select the collar type from the first drop down list and the battery type from the second drop down list. Depending on the collar type, different collar options are available. Select all options your collar is equipped with.

Now you have to select the delivery date of your collar: Did you receive your collar before or after 9. July 2004? That was the date when a new beacon transmitter was introduced.

The program will remember the first three settings (Collar Type, Battery Type, and Delivery Date) even after a restart.

Now you need to select the right collar configuration. Depending on your type of collar and communication options, different settings will be selectable. This information is necessary to calculate a realistic lifetime expectation. For details refer to the chapters on collar configuration:

Fixes per SMS: The number of fixes which can be transmitted in one SMS (4.4.3.8 GSM mode).

Iridium Mode: The number of fixes transmitted in one Iridium message (4.4.3.13 Iridium).

Use GSM/Iridium schedule: Tick this box to not transfer the positions after the number of fixes per message is reached, but according to a schedule (4.1.5.5 GSM/Iridium Schedule).

Globalstar Mode: The number of fixes transmitted in one Globalstar message (4.4.3.12 Globalstar).

Argos Communication: The preheating time of the Argos transmitter, the number of data blocks per message and the repetition rate of the message (4.4.3.11 Argos Transmitter).

PA Power: Power Amplifier for the Argos transmitter.

SMS Reception Delay: Time lapse between the sending of an SMS by the collar and the time of receiving new schedules from the provider (4.4.3.10 SMS Reception Delay).

Position Transmission: Select whether you transmit every position, or if you only transmit every nth position to save energy and transmission costs (4.4.3.16 Position Transmission).

VHF/UHF Communication Time: The time in which the collar's RF data communication system is enabled. The collar can be programmed to reduce this time to save power (4.4.3.7 RF Communication Time).

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Proximity: The settings of the proximity sensor: listening interval and duration, and the time during which the sensor is enabled (4.4.3.14 Proximity Sensor).

4.1.5.2 GPS Schedule

To define a GPS schedule, select the GPS Schedule tab sheet. This is equivalent to creating a GPS schedule (see 4.1.1 Create GPS Schedule).

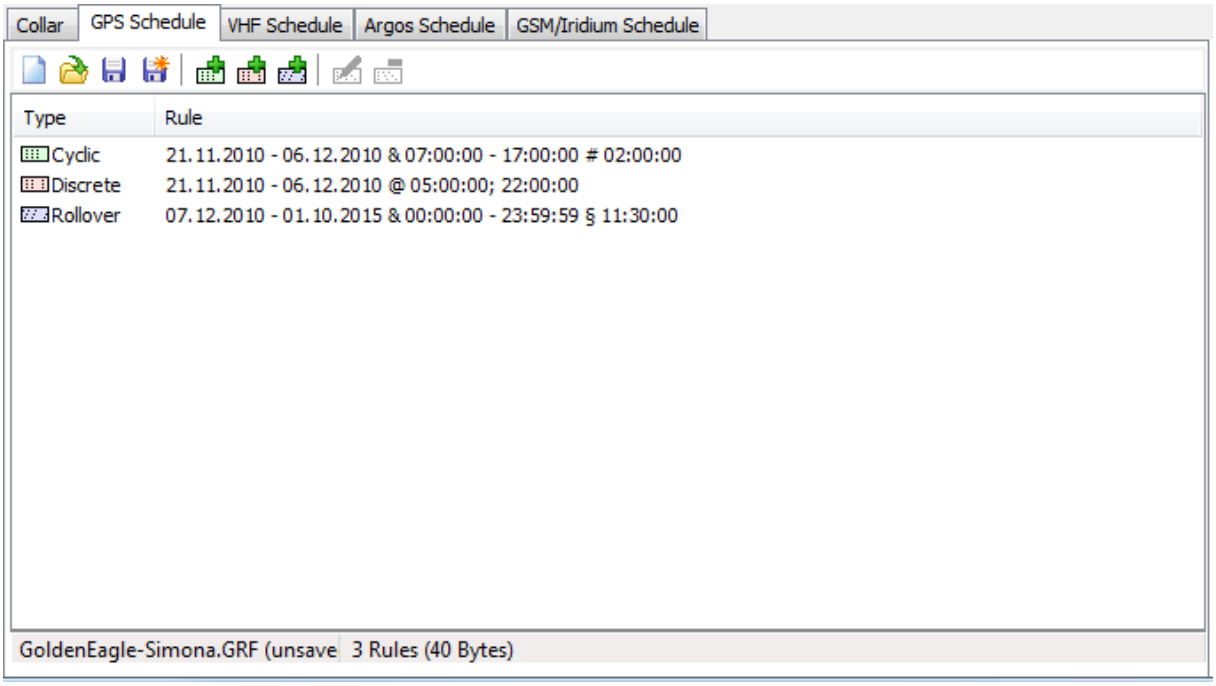

Figure 43: GPS Schedule tabs sheet in Lifetime Calculation

4.1.5.3 VHF Schedule

To define a VHF schedule, select the VHF Schedule tab sheet. This is equivalent to creating a beacon schedule (see 4.1.2 Create Beacon Schedule). You can only access the beacon schedule, if the corresponding collar option for VHF beacon beacon is checked.

4.1.5.4 Argos Schedule

To define an Argos schedule, select the Argos Schedule tab sheet. This is equivalent to creating an Argos schedule (see 4.1.3 Create Argos Schedule). You can only access the Argos schedule, if the collar option for Argos communication is checked.

4.1.5.5 GSM/Iridium Schedule

To define a GSM/Iridium schedule, select the GSM/Iridium Schedule tab. This is equivalent to creating an GSM/Iridium schedule (4.1.4 Create GSM/Iridium Schedule). You can only access the GSM/Iridium schedule, if the collar option for GSM or Iridium communication is checked.

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4.1.6 Send GPS Schedule

After a GPS rules file (.GRF) has been created it can be converted and loaded into a collar with the Send GPS Schedule command. It is strongly recommended that you deactivate the collar for this command by attaching the magnet to the collar.

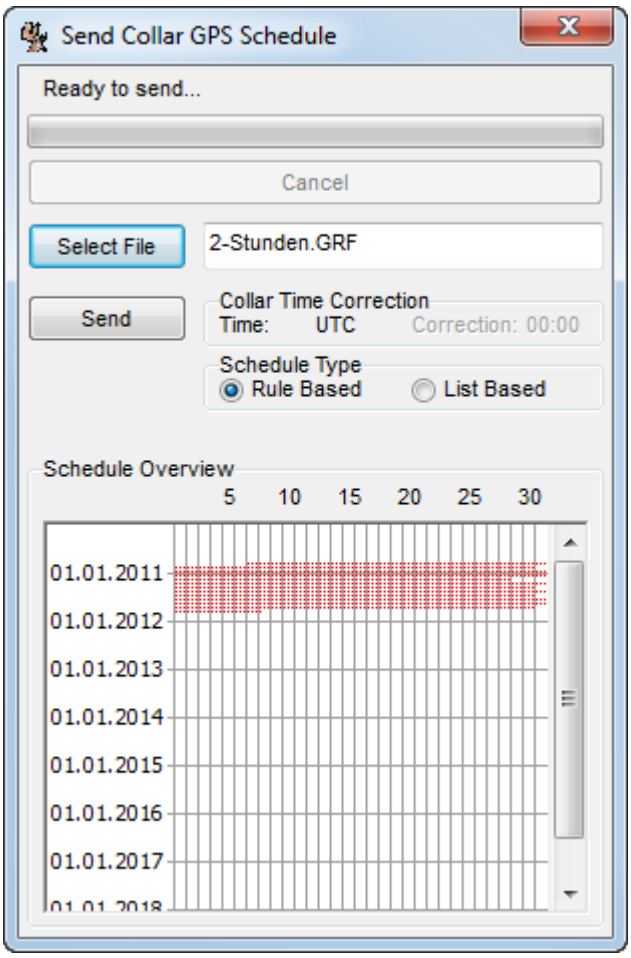

Figure 44: Send Collar GPS Schedule main window

In this window, shown in Figure 44, you can see what kind of time correction the collar is programmed to use. Time gives you information if the collar uses UTC or LMT. If it uses UTC then the times in the schedule will be interpreted as UTC times. If it uses LMT the times will be interpreted as LMT times and corrected by the term given by Correction. Collar Time Correction can be changed with the Collar Configuration command.

Next, you have to select a rules file by clicking the Select File button. An *Open File* dialog will open up and you can select a GPS rules file (.GRF). The file will then be loaded and the rules in the file will be converted to an internal event list, containing all times when the GPS should be activated. You can see this on the progress bar at the top of the window. After the file has been loaded and converted, the events will be shown in the white Schedule Overview area at the bottom. You can imagine this as an eight year long calendar where every row contains one month and every column contains eight hours with an empty row and column in between to make it easier to read. If the first point in the first row is painted red it means that there will be at least one GPS measurement at the date written on the left side between 0:00 and 8:00 in the morning. A red point in the third row at column 26 means: two months later 9th day between 8:00 and 16:00. Normally this is only to get an impression not for exact verification as described here.

After you have selected a file you have to choose what kind of schedule should be used: Rule based or list based. Rule Based means that the rules are stored in the collar while List Based means that the rules are transformed into discrete times and these will be stored in the collar. A rule-based schedule is much smaller than the list based schedule and faster to upload. Furthermore it is possible to download the rules from the collar again if you select rule based. List based only allows to download the list for verification but not to upload it to other collars afterward. If there are too many rules in the rules file, list based will automatically be

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selected, because the memory for a rule based schedule is restricted. Only using another smaller rules file will enable you to select rule based again.

After selecting a .GRF file, the Send button will be enabled. Press it to start the upload process: The entries will be sorted and sent to the collar. The text above the progress bar changes first to "*sorting entries*" and then to "*waiting for the connection*" with the collar. After connection has been established, the upload will start. If no connection could be established, an error messages will appear. Please refer to Appendix A: Error messages on error messages.

Now the data will be transmitted. This will take up to several minutes for a list based schedule and less than a minute for a rule based schedule. In case of a communication error, you will be asked if you want to retry or abort. Take into account that if data has already been sent, the collar's memory for events has been partly overwritten and might be corrupted! If you choose to cancel the transfer it is strongly recommended to restart the upload immediately.

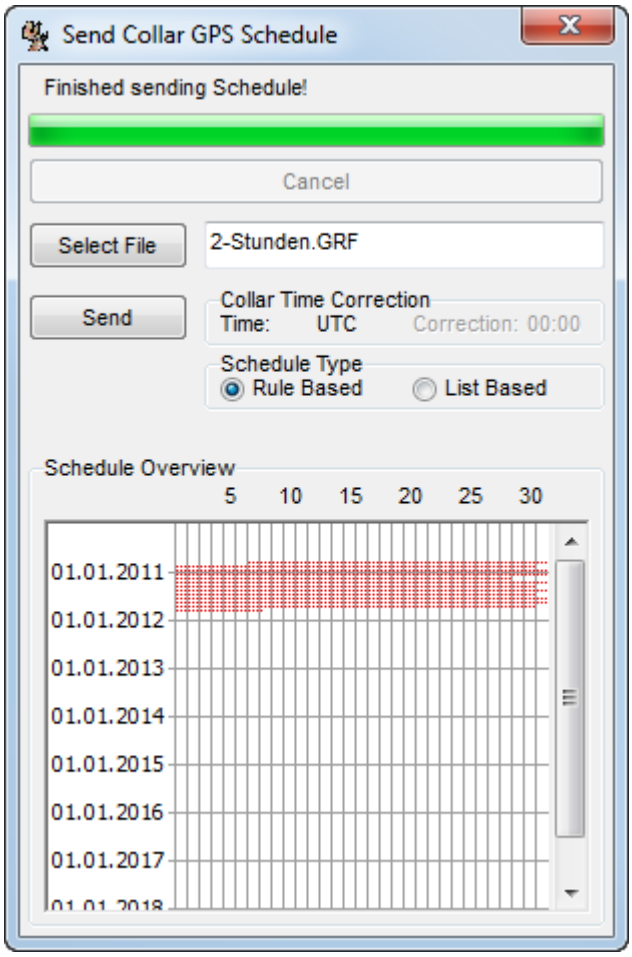

Figure 45: Send Collar GPS Schedule main window

After a successful upload, a reset is send automatically to the collar to initiate the computation of the next measurement. This is done without notification, so with the next GPS positions check if they have been obtained according to the new schedule. You can also read the current collar configuration, which includes all schedules (see 4.4.7 Save Collar Information). Now you can close the upload window.

4.1.7 Send VHF Beacon Schedule

This command transfers a beacon rules file (.BRF) to the collar and activates the VHF beacon schedule. The command is very similar to 4.1.6 Send GPS Schedule. Since beacon schedules are always rule based there is no choice of list or rule based schedule.

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4.1.8 Send Argos Schedule

This command transfers an Argos schedule file (.ARS) to the collar and activates the Argos schedule. The command is very similar to 4.1.6 Send GPS Schedule. Since beacon schedules are always rule based there will be no choice of list or rule based schedule.

4.1.9 Send GSM/Iridium Schedule

This command transfers a GSM/Iridium schedule file (.GSF) to the collar and activates the GSM/Iridium schedule. It allows you select a file by opening an open file dialog similar to 4.1.6 Send GSM/Iridium schedule and to send this file to the collar. The schedule is not checked for validity. The times stated in the schedule will always been treated as the times according to the receiving collar's UTC correction.

4.1.10 Send Proximity GPS Schedule

This command transfers a GPS schedule file (.GRF) to the collar which can be activated whenever an UHF ID tag signal is received from the collar (GPS Plus Collars with UHF radio communication only). In this case it overrules the standard GPS schedule until one hour after the ID signal has been received for the last time.

4.1.11 Receive GPS Schedule

To check the entries in a collar, the GPS schedule can be downloaded. A Window will open while waiting for the connection with the collar. If no connection can be established, the command will be aborted. After connection has been established, a file selection dialog will appear and you can select a name for the file in which the times will be stored. Then the main window for the download will appear (see Figure 46). The file content depends on the schedule type used in the collar: A rule based schedule will result in a rule file that again can be used for other collars and a list based in a large times list usable only for verification.

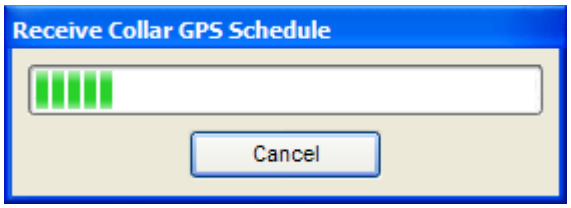

Figure 46: Receive GPS Schedule main window

The progress bar will not start immediately after the window appeared. Since the data rate is limited to 115200 kbit/s, which is the fastest rate possible on a standard PC with serial communication, the transfer can take up to two minutes if the schedule is list based while taking only seconds if it is rule based. If you choose to cancel the download, all data received

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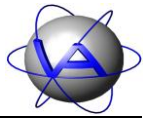

until this moment will be stored in the file. The file from a rule based schedule looks like the rules in the Create GPS Schedule dialog (see section 4.1.1).

List based schedule files should look something like you see in Figure 47. The header indicates UTC (Universal Time Coordinated) and LMT (Local Mean Time) if the UTC Correction is enabled. This corrects the UTC to the local time of your study area. If no valid UTC correction is stored in the collar, all times will be given in UTC only. If the defined GPS time rules do not fill the complete of the collar, the unused space will be filled with measurements every 6 hours starting at the last measurement.

```
UTC date UTC time LMT date LMT time
13.12.2001 22:30:00 14.12.2001 00:30:00
13.12.2001 23:30:00 14.12.2001 01:30:00
14.12.2001 00:30:00 14.12.2001 02:30:00
                    :
                    :
                    :
14.12.2001 20:30:00 14.12.2001 22:30:00
14.12.2001 21:30:00 14.12.2001 23:30:00
14.12.2001 22:30:00 15.12.2001 00:30:00
```

Figure 47: GPS times file from list-based schedule

4.1.12 Receive VHF Beacon Schedule

Receiving the VHF beacon schedule is equal to 4.1.11 Receive GPS Schedule, but the resulting file will always be a reusable rules file.

4.1.13 Receive Argos Schedule

Receiving the Argos schedule is equal to 4.1.11 Receive GPS Schedule command, but the resulting file will always be a reusable rules file.

```
<?xml version="1.0" encoding="UTF-8"?>
<schedule time="2007-01-17T12:44:33Z" type="Argos" creator="GPS Plus -
http://www.vectronic-aerospace.com">
  <period endDate="2005-01-01" duration="P3DT08H00M00S" startDate="2000-01-01">
    <onTime offset="P3DT00H00M00S" duration="P0DT08H00M00S"/>
  </period>
</schedule>
```

Figure 48: Example of an Argos schedule file (XML standard)

The first line is part of the coding. The second line (node `period`) gives you the following information:

`time`	date and time of the creation of the schedule
`creator`	program in which the schedule has been created

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Date and time in this line is coded as follows (red letters are originally given in the code, other letters are placeholder for numbers): "YYYY-MM-DDTHH:MM:SSZ", in which Y=year, M=month, D=day, T=time, H=hour, M=minute, S=second, Z=Zulu time (equivalent to UTC).

The next line (node `period`) gives you the settings for the period in which the schedule is active:

`endDate`	last day on which the schedule is active
`duration`	duration of one loop
`startDate`	first day on which the schedule is active

Date in this line is coded as follows: "YYYY-MM-DD" (description see above), duration is coded as P=period/duration, D=days, T=time, H=hours, M=minutes, S=seconds. In our example the period has a duration of 3 days, 8 hours, 0 minutes and 0 seconds.

The next line gives you the settings for the actual transmission time (node `onTime`) during each loop (coding as in node `period`):

`offset`	time difference between begin of loop and switching on the Argos transmitter
`duration`	duration of the time in which the Argos transmitter is switched on

For details on the Argos schedule, refer to 4.1.3 Create Argos Schedule.

4.1.14 Receive GSM/Iridium Schedule

A save file dialog is opened, in which you can select a file name for the schedule. The schedule file can be edited and used to program other collars. The schedule itself is an XML file and should like similar to Figure 49.

```
<?xml version="1.0" encoding="UTF-8"?>
<gsmSchedule time="2008-02-28T16:58:24Z" creator="GPS Plus - http://www.vectronic-
aerospace.com">
<rule stop="2008-08-06T00:00:00Z" start="2007-08-06T00:00:00Z" period="P1DT12H0M"/>
<rule stop="2009-08-06T00:00:00Z" start="2008-08-06T00:00:00Z" period="P1DT12H0M"/>
<rule stop="2010-08-06T00:00:00Z" start="2009-08-06T00:00:00Z" period="P1DT12H0M"/>
</gsmSchedule>
```

Figure 49: Example of a GSM schedule file (XML standard)

The first line is part of the coding. The second line (node `gsmSchedule`) gives you the following information:

`time`	date and time of the creation of the schedule
`creator`	program in which the schedule has been created

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The next lines (node `rule`) give you the actual rules of the schedule with

`stop`	end date and time in UTC of the time period in which the rule is active
`start`	start date and time in UTC of the time period in which the rule is active
`period`	time span between two communication attempts.

Date and time in `time`, `stop`, and `start` is coded as follows (red letters are originally given in the code, other letters are placeholder for numbers): "YYYY-MM-DD**T**HH:MM:SS**Z**", in which Y=year, M=month, D=day, **T**=time, H=hour, M=minute, S=second, **Z**=Zulu time (equivalent to UTC).

Date and time in period is coded as follows: "YYYY-MM-DD" (description see above), duration is coded as **P**=period/duration, D=days, **T**=time, H=hours, M=minutes. In our example the period has a duration of 1 day, 12 hours, 0 minutes.

For details on the GSM/Iridium schedule, refer to 4.1.4 Create GSM/Iridium Schedule.

4.1.15 Receive Proximity GPS Schedule

Receiving the Proximity GPS schedule is equal to 4.1.11 Receive GPS Schedule command, but the resulting file will always be a reusable rules file.

4.1.16 Clear GSM/Iridium Schedule

This command clears the GSM or Iridium schedule. This is the only way of disabling this schedule. After successfully clearing the schedule, a success message is shown.

4.2 GPS Menu

In the GPS menu commands concerning the measured position data of the collar are available.

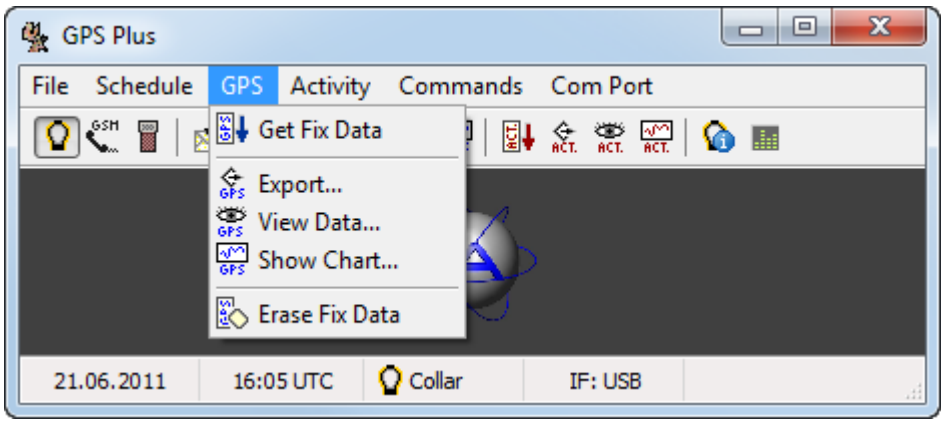

Figure 50: Main window with GPS menu (in Collar mode)

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4.2.1 Get Fix Data

This is probably the most important command: It will download all position measurement data recorded in the collar. A Window will open (see Figure 51) while waiting for the connection with the collar. If no connection can be established the command will be aborted.

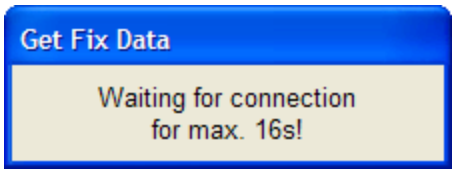

Figure 51: Wait for connection window

After connection has been established a *Save file* dialog will appear in which you can select a file name to store the position data as .GDF (GPS data file) file; by default it will be stored in the folder GPS_Plus\GPS Data (based on the base data path) and the default file name will be "`GPS_Collarxxxxx_YYMMDDHHMMSS.GDF`", where xxxxx is the 5-digit collar ID, followed by year (Y), month (M), day (D), hour (H), minute (M), and second (S) of export. Then the main window for the download will appear (see Figure 52).

The progress bar will not start immediately after the window appeared. Depending on the number of measurements stored in the collar, the download can take up to several minutes. If you choose to cancel the download, all data received until this moment will be stored in the file.

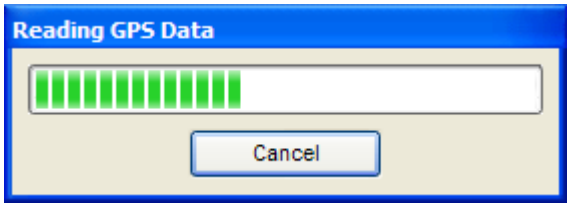

Figure 52: Reading GPS data progress bar window

4.2.2 Export GPS Data

This command can also be accessed via the toolbar symbol shown left. It is rather a conversion than an export because the source is always an already stored position data file. Position Data can be exported to the following formats:

- ASCII Table has equal sized (number of characters) fields for every row and thus can easily be read by humans (as a table).
- Spreadsheet data (.CSV) is machine readable, which means table entries are separated by a freely definable character that can be defined in the options form.

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- Database table (DBase format) is a DBase table only readable after being imported into a database system.
- .GPX (GPS exchange) is a XML format containing waypoints and can be imported in several GPS software applications.
- .KML (Keyhole Markup Language) is a. XML format used in Google earth to display tracks, points of interest and such.
- .KMZ (Zipped Keyhole Markup Language) is a zipped XML format for Google Earth to display tracks, points of interest and such.
- .BTX (BioTelemetry Exchange) is an XML format defined by VECTRONIC Aerospace, which will make it easier to exchange acquired data over system boundaries.

The GPS Data Export window (see Figure 53) contains one field for the source file name and one for the Export file name. Both file names are selected via the Choose buttons to the right. You can select multiple files as source, but if you do so you will not be able to choose the export name. The export name will be generated from the source name by changing the extension to the extension of the selected export type. You may change the file name (unless you have selected multiple source files) by clicking on the Choose button for the export file, but not by simply typing it in the Export window.

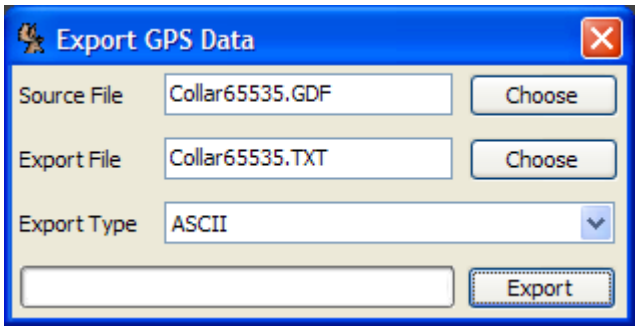

Figure 53: GPS Data ASCII Export window

After source and export file name have been selected, the Export button is enabled. Select the export type from the dropdown list, then start the export. After export has been finished, the Choose buttons will be enabled again.

If an export file already exist, you will be prompted before it will be overwritten. If you deny overwriting the file, you will be prompted for a new file name. If you cancel the selection of a new file name, the corresponding source file will not be exported and in case of multiple source files selected the next source file is exported.

For export options (table header, value order, separation character) see 3.1.8.7 Export I Tab Sheet and 3.1.8.8 Export II Tab Sheet. An example for the resulting file of the ASCII export is given in Figure 54. Since order and selection of columns can be set in the Options Form

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Export tab sheet, the actual file may differ from the example, but the structure will be quite the same.

4.2.2.1 Description of Values in Exported Files

No	Line index
UTC date and time	Time in universal time coordinated (equivalent to GMT.
LMT date and time	Local mean time, depending on the value set in UTC Correction (see 3.1.8.10 Miscellaneous Tab Sheet).
ECEF X, Y, and Z	Coordinates in the Earth Centred Earth Fixed coordinate system.
Latitude, Longitude, Height	Geographical position based on WGS84.
DOP (Dilution of Precision)	This is a value for the geometric constellation of the received GPS satellites.
Nav	Type of fix obtained: There are five types of fixes: No No fix could be acquired 1S Only one satellite was used. This fix is very inaccurate. 2S Only two satellites were used. This fix is very inaccurate. 2D Three satellites were used. This fix used the height information of the last fix as fixed. 3D At least four satellites were used. This is an accurate fix
Validated	This is a special feature of the used GPS receiver: A fix is considered validated, if the receiver uses five or more satellites to calculate the position and the DOP is less than 10.0. Since the navigation solution needs only four satellites, the equations are over determined by one or more values. This can be used to calculate some validation on the range measurements. If this has succeeded, the fix is considered validated. Consider validated as the best fix quality you can get.
Sats used	Number of satellites used for the fix.
Sat No / C/No	Channels of the GPS receiver with two columns each containing the satellite number and the carrier to noise value in dBHz.
Clock Offset	Differential GPS clock offset of receiver
Pseudo 01 to 12	Differential GPS pseudo ranges for each receiver channel (one satellite per channel, corresponds to Sat No / C/No)
Main	Voltage of the main battery in Volts.

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Beacon	Voltage of the beacon battery in Volts.
Temp	Temperature of the collar. This is not necessarily the ambient temperature, since the animal and/or the sun will warm up the collar.
Transformed Coordinates	One or two columns: The headings may vary depending on the coordinate system selected. There may be one or two ordinates. If there is only one transformed coordinate every six or seventh datasets, then you probably have no GeoDLL license. Please contact VECTRONIC Aerospace to purchase this license.
Remarks	This field is always at the last position. It cannot be disabled and its length may vary. At the moment it contains messages concerning only the coordinate transformation.

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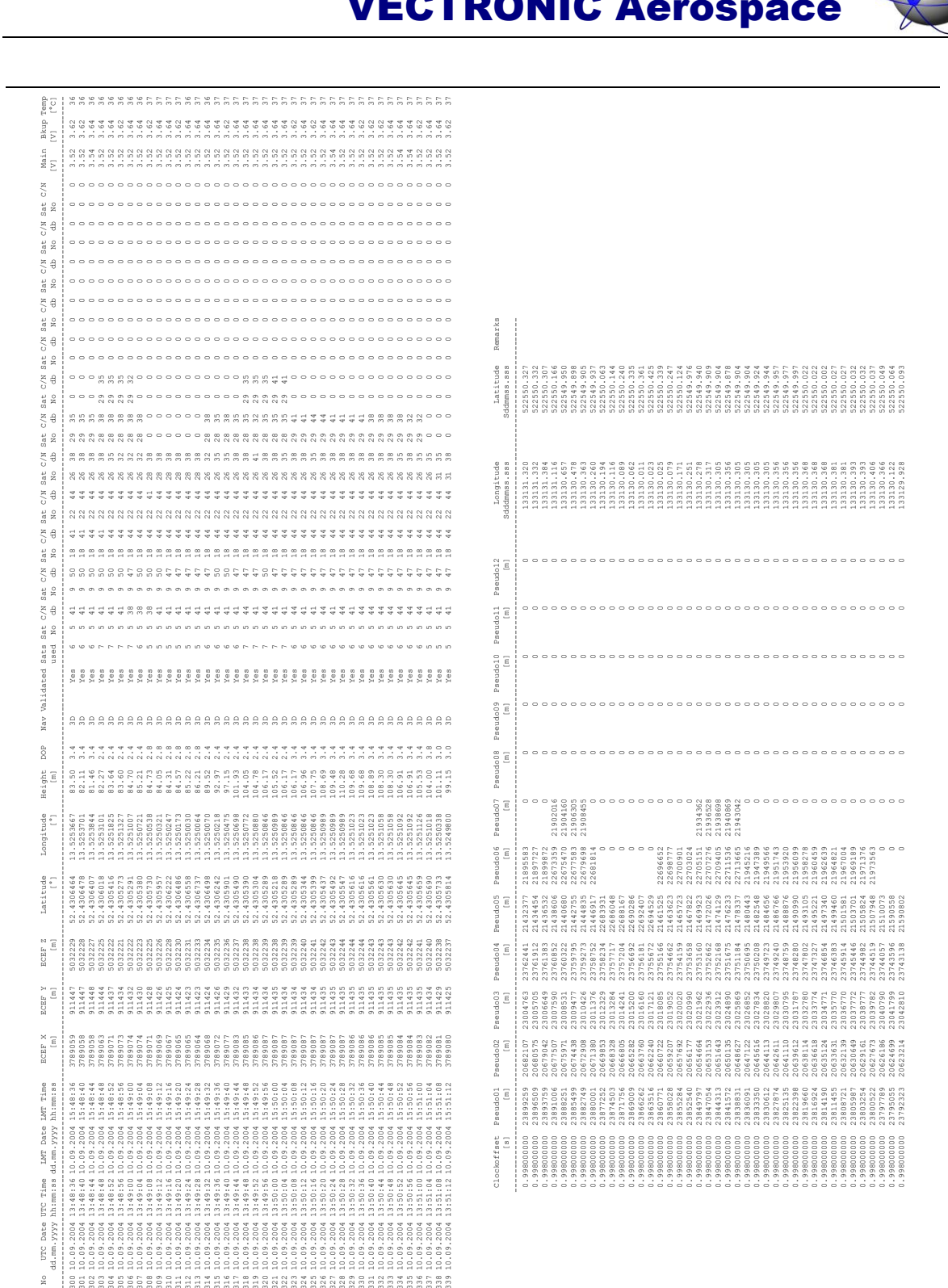

No	UTC Date dd.mm.yyyy	UTC Time hh:mm:ss	LMT Date dd.mm.yyyy	LMT Time hh:mm:ss	ECEF X [m]	ECEF Y [m]	ECEF Z [m]	Latitude [°]	Longitude [°]	Height [m]	DOP	Nav	Validated	Sats used	Sat No	C/N db	Sat No	C/N db	Sat No	C/N db	Sat No	C/N db	Sat No	C/N db	Sat No	C/N db	Main [V]	Bkup [V]	Temp [°C]
300	10.09.2004	13:48:36	10.09.2004	15:48:36	3789059	911447	5032229	52.4306464	13.5253667	83.50	3.4	3D	Yes	6	5	41	9	50	18	41	22	44	26	38	29	35	0	0	0	0	3.52	3.62	36
301	10.09.2004	13:48:40	10.09.2004	15:48:40	3789058	911447	5032228	52.4306478	13.5253701	82.11	3.4	3D	Yes	6	5	41	9	50	18	41	22	44	26	38	29	35	0	0	0	0	3.52	3.62	36
302	10.09.2004	13:48:44	10.09.2004	15:48:44	3789058	911448	5032227	52.4306407	13.5253844	81.46	3.4	3D	Yes	7	5	41	9	50	18	44	22	44	26	38	29	35	0	0	0	0	3.54	3.64	36
303	10.09.2004	13:48:48	10.09.2004	15:48:48	3789061	911446	5032225	52.4306348	13.5253911	82.27	2.4	3D	Yes	7	5	41	9	50	18	44	22	44	26	38	29	38	0	0	0	0	3.54	3.64	36
304	10.09.2004	13:48:52	10.09.2004	15:48:52	3789071	911437	5032222	52.4306416	13.5251825	83.64	2.4	3D	Yes	7	5	41	9	50	18	44	22	44	26	35	28	38	0	0	0	0	3.52	3.64	36
305	10.09.2004	13:48:56	10.09.2004	15:48:56	3789073	911434	5032221	52.4305273	13.5251327	83.60	2.4	3D	Yes	7	5	41	9	50	18	44	22	44	26	32	28	38	29	35	0	0	3.52	3.62	36
306	10.09.2004	13:49:00	10.09.2004	15:49:00	3789074	911432	5032222	52.4305291	13.5251007	84.70	2.4	3D	Yes	7	5	38	9	47	18	44	22	44	26	32	28	38	29	32	0	0	3.52	3.64	36
307	10.09.2004	13:49:04	10.09.2004	15:49:04	3789074	911430	5032223	52.4305380	13.5250721	85.21	2.4	3D	Yes	6	5	38	9	50	18	44	22	44	26	32	28	38	29	38	0	0	3.52	3.64	36
308	10.09.2004	13:49:08	10.09.2004	15:49:08	3789071	911428	5032225	52.4305730	13.5250538	84.73	2.8	3D	Yes	5	5	38	9	50	18	44	22	41	28	38	0	0	0	0	0	0	3.52	3.62	37
309	10.09.2004	13:49:12	10.09.2004	15:49:12	3789069	911426	5032226	52.4305957	13.5250321	84.05	2.8	3D	Yes	5	5	41	9	50	18	44	22	44	28	38	0	0	0	0	0	0	3.52	3.62	37
310	10.09.2004	13:49:16	10.09.2004	15:49:16	3789067	911424	5032228	52.4306222	13.5250047	84.31	2.8	3D	Yes	5	5	41	9	47	18	44	22	44	28	38	0	0	0	0	0	0	3.52	3.62	37
311	10.09.2004	13:49:20	10.09.2004	15:49:20	3789065	911424	5032230	52.4306486	13.5250173	84.57	2.8	3D	Yes	5	5	41	9	47	18	44	22	44	28	38	0	0	0	0	0	0	3.52	3.62	37
312	10.09.2004	13:49:24	10.09.2004	15:49:24	3789065	911423	5032231	52.4305858	13.5250030	85.22	2.8	3D	Yes	5	5	41	9	47	18	44	22	44	28	38	0	0	0	0	0	0	3.52	3.64	36
313	10.09.2004	13:49:28	10.09.2004	15:49:28	3789064	911423	5032233	52.4306737	13.5250064	86.21	2.8	3D	Yes	5	5	41	9	47	18	44	22	44	28	38	0	0	0	0	0	0	3.52	3.64	37
314	10.09.2004	13:49:32	10.09.2004	15:49:32	3789068	911424	5032234	52.4306498	13.5250070	89.52	2.4	3D	Yes	6	5	41	9	47	18	44	22	44	26	32	28	38	0	0	0	0	3.52	3.64	36
315	10.09.2004	13:49:36	10.09.2004	15:49:36	3789072	911426	5032235	52.4306242	13.5250218	92.97	2.4	3D	Yes	6	5	41	9	50	18	44	22	44	26	35	28	38	0	0	0	0	3.52	3.64	37
316	10.09.2004	13:49:40	10.09.2004	15:49:40	3789073	911429	5032236	52.4305940	13.5250495	97.15	2.4	3D	Yes	6	5	41	9	50	18	44	22	44	26	35	28	38	0	0	0	0	3.52	3.64	37
317	10.09.2004	13:49:44	10.09.2004	15:49:44	3789083	911432	5032237	52.4305731	13.5250745	101.29	2.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	35	28	38	0	0	0	0	3.52	3.64	37
318	10.09.2004	13:49:48	10.09.2004	15:49:48	3789085	911433	5032238	52.4305390	13.5250772	104.05	2.4	3D	Yes	7	5	44	9	47	18	44	22	44	26	38	28	35	29	35	0	0	3.52	3.64	37
319	10.09.2004	13:49:52	10.09.2004	15:49:52	3789086	911434	5032238	52.4305304	13.5250880	104.78	2.4	3D	Yes	7	5	41	9	47	18	44	22	44	26	41	28	32	29	35	0	0	3.52	3.64	37
320	10.09.2004	13:49:56	10.09.2004	15:49:56	3789087	911434	5032239	52.4305289	13.5250846	106.17	2.4	3D	Yes	7	5	44	9	50	18	44	22	44	26	38	28	35	29	35	0	0	3.52	3.64	37
321	10.09.2004	13:50:00	10.09.2004	15:50:00	3789087	911435	5032238	52.4305218	13.5250989	105.52	2.4	3D	Yes	7	5	41	9	47	18	44	22	44	26	38	28	35	29	41	0	0	3.52	3.64	37
322	10.09.2004	13:50:04	10.09.2004	15:50:04	3789087	911434	5032239	52.4305289	13.5250846	106.17	2.4	3D	Yes	6	5	41	9	47	18	44	22	44	26	38	28	35	29	41	0	0	3.52	3.64	37
323	10.09.2004	13:50:08	10.09.2004	15:50:08	3789087	911434	5032240	52.4305349	13.5250846	106.96	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	41	0	0	0	0	3.52	3.62	37
324	10.09.2004	13:50:12	10.09.2004	15:50:12	3789087	911434	5032240	52.4305344	13.5250846	106.76	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	41	0	0	0	0	3.52	3.62	37
325	10.09.2004	13:50:16	10.09.2004	15:50:16	3789087	911434	5032241	52.4305399	13.5250846	107.75	3.4	3D	Yes	6	5	41	9	47	18	44	22	44	26	35	29	44	0	0	0	0	3.52	3.62	37
326	10.09.2004	13:50:20	10.09.2004	15:50:20	3789087	911435	5032242	52.4305437	13.5250989	108.69	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	41	0	0	0	0	3.52	3.64	37
327	10.09.2004	13:50:24	10.09.2004	15:50:24	3789087	911435	5032243	52.4305492	13.5250989	109.48	3.4	3D	Yes	6	5	41	9	47	18	44	22	44	26	38	29	41	0	0	0	0	3.52	3.64	37
328	10.09.2004	13:50:28	10.09.2004	15:50:28	3789087	911435	5032244	52.4305547	13.5250989	110.28	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	41	0	0	0	0	3.52	3.64	37
329	10.09.2004	13:50:32	10.09.2004	15:50:32	3789086	911435	5032244	52.4305616	13.5251023	109.68	3.4	3D	Yes	6	5	41	9	47	18	44	22	44	26	38	29	41	0	0	0	0	3.52	3.64	37
330	10.09.2004	13:50:36	10.09.2004	15:50:36	3789086	911435	5032244	52.4305566	13.5251023	109.09	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	41	0	0	0	0	3.52	3.62	37
331	10.09.2004	13:50:40	10.09.2004	15:50:40	3789086	911435	5032244	52.4305561	13.5251023	108.89	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	38	0	0	0	0	3.52	3.62	37
332	10.09.2004	13:50:44	10.09.2004	15:50:44	3789085	911435	5032243	52.4305630	13.5251058	108.30	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	38	0	0	0	0	3.52	3.64	37
333	10.09.2004	13:50:48	10.09.2004	15:50:48	3789085	911435	5032243	52.4305630	13.5251058	108.30	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	38	0	0	0	0	3.52	3.64	37
334	10.09.2004	13:50:52	10.09.2004	15:50:52	3789084	911435	5032242	52.4305645	13.5251092	106.91	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	35	29	38	0	0	0	0	3.54	3.64	37
335	10.09.2004	13:50:56	10.09.2004	15:50:56	3789084	911435	5032242	52.4305645	13.5251092	106.91	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	38	29	32	0	0	0	0	3.54	3.64	37
336	10.09.2004	13:51:00	10.09.2004	15:51:00	3789083	911435	5032241	52.4305659	13.5251126	105.53	3.4	3D	Yes	6	5	44	9	47	18	44	22	44	26	35	29	32	0	0	0	0	3.52	3.62	37
337	10.09.2004	13:51:04	10.09.2004	15:51:04	3789082	911430	5032240	52.4305660	13.5251160	103.74	3.4	3D	Yes	5	5	41	9	47	18	44	22	44	31	35	0	0	0	0	0	0	3.52	3.64	37
338	10.09.2004	13:51:08	10.09.2004	15:51:08	3789081	911429	5032238	52.4305733	13.5250938	101.11	3.0	3D	Yes	5	5	41	9	47	18	44	22	44	31	38	0	0	0	0	0	0	3.52	3.64	37
339	10.09.2004	13:51:12	10.09.2004	15:51:12	3789080	911425	5032237	52.4305814	13.5249800	99.15	3.0	3D	Yes	5	5	41	9	47	18	44	22	44	31	38	0	0	0	0	0	0	3.52	3.62	37

Clockoffset [s]	Pseudo01 [m]	Pseudo02 [m]	Pseudo03 [m]	Pseudo04 [m]	Pseudo05 [m]	Pseudo06 [m]	Pseudo07 [m]	Pseudo08 [m]	Pseudo09 [m]	Pseudo10 [m]	Pseudo11 [m]	Pseudo12 [m]	Longitude DDdmmss.sss	Latitude DDdmmss.sss	Remarks
0.998000000	23899259	20682107	23004763	23762441	21432377	21895583	0	0	0	0	0	0	131131.320	522550.327	
0.998000000	23896509	20680575	23005705	23761912	21434454	21897727	0	0	0	0	0	0	131131.332	522550.332	
0.998000000	23893759	20679042	23006649	23761383	21436532	21899872	0	0	0	0	0	0	131131.384	522550.307	
0.998000000	23891009	20677509	23007593	23760854	21438606	21902016	21902016	0	0	0	0	0	131131.436	522550.266	
0.998000000	23888251	20675971	23008537	23760325	21440680	21904160	21904160	0	0	0	0	0	131131.487	522549.966	
0.998000000	23885499	20674438	23009477	23759795	21442755	22677583	21906305	0	0	0	0	0	131130.478	522549.898	
0.998000000	23882749	20672908	23010426	23759273	21444835	22679698	21908455	0	0	0	0	0	131130.363	522549.905	
0.998000000	23880001	20671380	23011376	23758752	21446917	22681814	0	0	0	0	0	0	131130.260	522549.937	
0.998000000	23877252	20669853	23012329	23758234	22683931	0	0	0	0	0	0	0	131130.194	522550.063	
0.998000000	23874503	20668328	23013284	23757717	22686048	0	0	0	0	0	0	0	131130.116	522550.144	
0.998000000	23871756	20666802	23014241	23757199	22688166	0	0	0	0	0	0	0	131130.048	522550.240	
0.998000000	23869010	20665282	23015201	23756692	22690286	0	0	0	0	0	0	0	131130.002	522551.335	
0.998000000	23866262	20663760	23016160	23756181	22692407	0	0	0	0	0	0	0	131130.011	522550.361	
0.998000000	23863516	20662240	23017121	23755672	22694529	0	0	0	0	0	0	0	131130.023	522550.425	
0.998000000	23860771	20660722	23018085	23755166	21461525	22696652	0	0	0	0	0	0	131130.025	522550.339	
0.998000000	23858028	20659207	23019052	23754662	21463623	22698777	0	0	0	0	0	0	131130.079	522550.247	
0.998000000	23855284	20657692	23020020	23754159	21465723	22700901	0	0	0	0	0	0	131130.171	522550.124	
0.998000000	23852541	20656178	23020989	23753657	21467823	22703026	0	0	0	0	0	0	131130.271	522549.996	
0.998000000	23849797	20654664	23021962	23753160	21469923	22705151	21934362	0	0	0	0	0	131130.278	522549.940	
0.998000000	23847054	20653153	23022936	23752662	21472026	22707276	21936528	0	0	0	0	0	131130.317	522549.909	
0.998000000	23844313	20651643	23023912	23752168	21474129	22709405	21938698	0	0	0	0	0	131130.305	522549.904	
0.998000000	23841572	20650135	23024890	23751675	21476233	22711536	21940869	0	0	0	0	0	131130.356	522549.878	
0.998000000	23838831	20648627	23025869	23751184	21478337	22713665	21943042	0	0	0	0	0	131130.305	522549.904	
0.998000000	23836091	20647122	23026852	23750695	21480443	21943216	0	0	0	0	0	0	131130.305	522549.904	
0.998000000	23833352	20645618	23027836	23750208	21482550	21945391	0	0	0	0	0	0	131130.305	522549.904	
0.998000000	23830612	20644113	23028820	23749723	21484656	21949566	0	0	0	0	0	0	131130.305	522549.944	
0.998000000	23827874	20642611	23029807	23749240	21486766	21951743	0	0	0	0	0	0	131130.356	522549.957	
0.998000000	23825135	20641110	23030795	23748759	21488876	21953920	0	0	0	0	0	0	131130.356	522549.997	
0.998000000	23822398	20639612	23031787	23748280	21490990	21956099	0	0	0	0	0	0	131130.356	522549.997	
0.998000000	23819660	20638114	23032780	23747802	21493105	21958278	0	0	0	0	0	0	131130.368	522550.022	
0.998000000	23816924	20636618	23033774	23747326	21495221	21960459	0	0	0	0	0	0	131130.368	522550.022	
0.998000000	23814188	20635124	23034771	23746851	21497340	21962639	0	0	0	0	0	0	131130.368	522550.022	
0.998000000	23811455	20633631	23035770	23746383	21499460	21964821	0	0	0	0	0	0	131130.381	522550.027	
0.998000000	23808721	20632139	23036770	23745914	21501581	21967004	0	0	0	0	0	0	131130.381	522550.027	
0.998000000	23805987	20630649	23037772	23745446	21503701	21969189	0	0	0	0	0	0	131130.393	522550.032	
0.998000000	23803254	20629161	23038777	23744982	21505824	21971376	0	0	0	0	0	0	131130.393	522550.032	
0.998000000	23800522	20627673	23039782	23744519	21507948	21973563	0	0	0	0	0	0	131130.406	522550.037	
0.998000000	23797789	20626186	23040789	23744056	21510073	0	0	0	0	0	0	0	131130.426	522550.044	
0.998000000	23795057	20624698	23041799	23743596	21512199	0	0	0	0	0	0	0	131130.426	522550.049	
0.998000000	23792323	20623214	23042810	23743138	21590802	0	0	0	0	0	0	0	131129.928	522550.093	

Figure 54: GPS ASCII Export file listing example

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4.2.3 View GPS Data

This command can also be accessed via the toolbar symbols shown to the left. It displays the content of a GPS data file saved on the PC from a collar, merged from SMS messages or read from a Handheld Terminal (see Figure 55). It shows all data of a single fix in a structured environment. You can easily navigate through the data sets with keyboard and mouse.

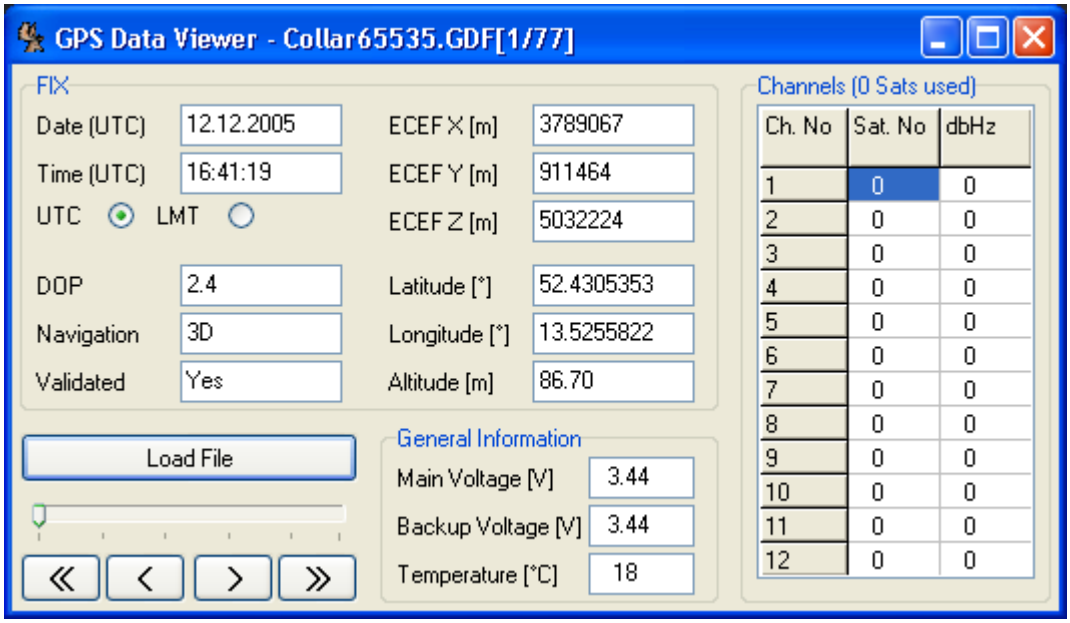

Figure 55: GPS Data Viewer with file open

First you need to select a file via the Load File button: A standard windows open file dialog will open up with *.GDF as extension and the default directory for GPS data selected. Alternatively you can drag & drop a GPS Data File from the windows explorer or any other source. After selection of a valid GPS data file (GDF), the first data set will be displayed immediately. The file name, the number of the current data set, and the number of data sets are displayed in the windows title bar. All data fix results are displayed in the FIX group box including time and date, which can be displayed as UTC or LMT. The satellites that were used are displayed in the Channels Group box (the number of used satellites is displayed in the group box caption). Voltages and Temperature are displayed in the General Information Group box.

To navigate through the data file, you can use the buttons and the track bar on the lower left. The double arrows (<< >>) jump back and forth 50 data 50 data sets, the single arrows (< >) only one data set. Via the track bar, you can move easily through the data.Using the keyboard the cursor keys equal the single arrows, page up/down correspond to the double arrows. Home and End key move to the beginning and the end of the data file.

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4.2.4 Show GPS Chart

This command can also be accessed via the toolbar symbol shown to the left. This will show downloaded position data graphically. You can print and store the chart.

A window with an empty chart will appear (see Figure 56). You can load a position file from the File menu via an open file dialog or by dragging a file from the windows file explorer (or any other windows application supporting drag & drop) and dropping it to the chart. The data will appear in the chart and the file name will be added to the windows caption. The chart will automatically be scaled to show every point of the data. If you move the cursor over the chart, a small text will appear near the cursor showing the coordinates of the cursor. A double click on a data point (positioning has to be very precise) will show the date and time of the corresponding measurement in a grey box above to the right of the point. Just click once anywhere on the chart to make it disappear. From the file menu you can easily save the chart as a Windows Meta File or a Bitmap. Printing is even easier: Just press *Print* in the file menu and the chart will be printed in landscape on a selectable printer. You can zoom in by rolling the mouse wheel upwards or by left clicking and dragging a square in the chart; it is important to click and drag from top left to bottom right. To zoom out, roll the mouse wheel downwards or left click and drag left and down, then release. The chart will then be shown in its first appearance. Right clicking and dragging moves the chart data. Right clicking only presents a pop up menu with zoom in, zoom out and zoom all to choose from. These commands are also visible in the view menu.

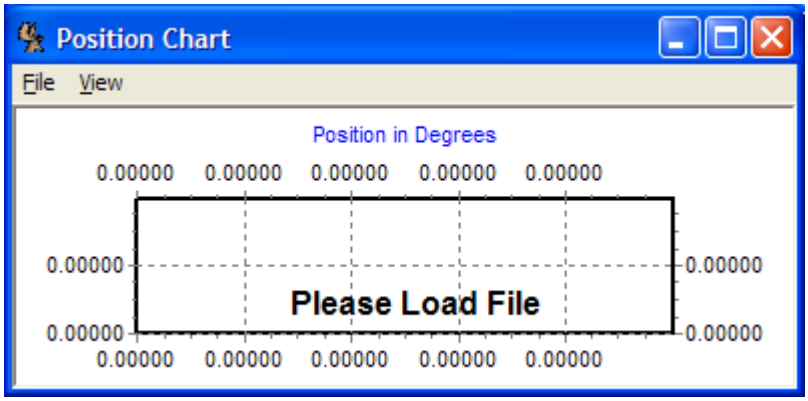

Figure 56: Position chart window with empty chart

Also in the view menu you can choose the chart units: You can view the chart in degrees (Figure 57) showing the position in red colour or in kilometres (Figure 58), which displays it in green. The view in kilometres is only an approximation.

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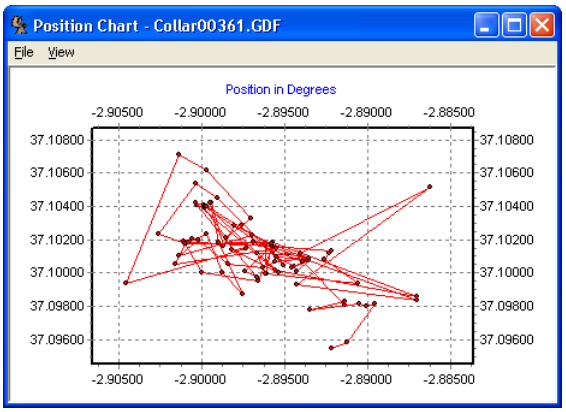

Figure 57: Position chart with loaded position data. Data is displayed in degrees and with lines connecting position points.

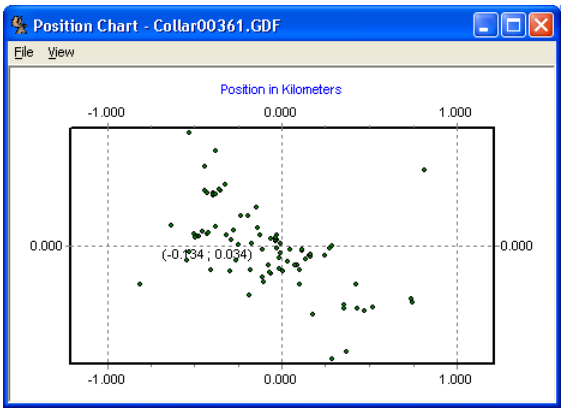

Figure 58 : Position chart with loaded position data and position info for one point. Data is displayed in kilometres and without lines.

4.2.5 Erase Fix Data

This erases the Positions stored in the collar! Be careful using this command. **There is no way to restore erased data!**

Before the erase procedure is started you will first be asked if you are sure to erase all position data (see Figure 59). If you confirm, there will be a 20 seconds countdown (see Figure 60). While the countdown is running you have your last chance to stop erasing the data by clicking on the Cancel button or pressing the <Esc>-key on your keyboard.

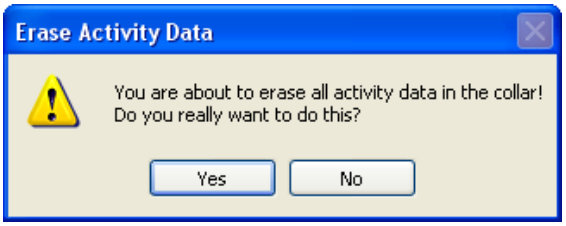

Figure 59: First request for confirmation of erasing fix data.

Figure 60: Countdown of erasing fix data

Once the countdown is over, there is no way of stopping any more. A Window will pop up while waiting for the connection with the collar. If no connection could be established the message will change to "Connection could not be established!" or "Erasing GPS memory NOT successful!" and the OK button will be enabled so that the window can be closed. Otherwise the Text will Change to "Erasing GPS Memory..." until the data is erased. Then the OK button will be enabled and you can close the window.

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4.3 Activity Menu

In the Activity menu commands concerning the measured temperature and activity sensors of the collar are available.

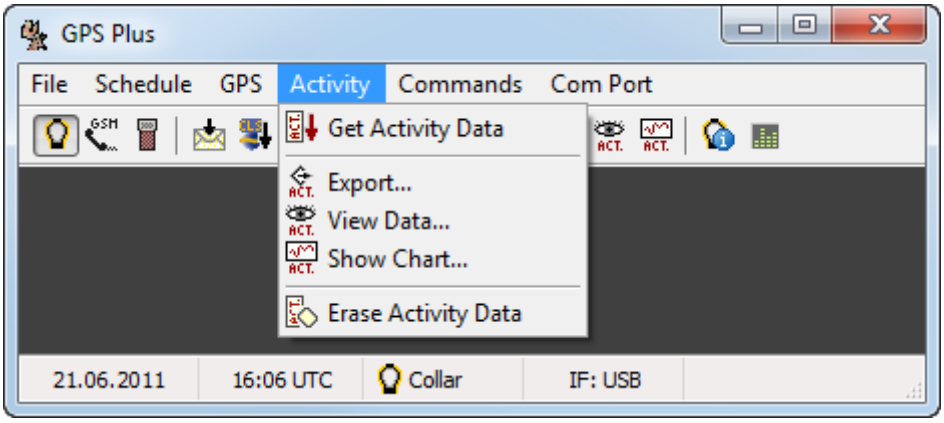

Figure 61: Main window with activity menu open (in Collar mode)

4.3.1 Get Activity Data

This command can also be accessed via the toolbar symbol shown to the left. This command will download the Activity Sensor and temperature data recorded in the collar. A Window will pop up while waiting for the connection with the collar (Figure 62). If no connection could be established the command will be aborted.

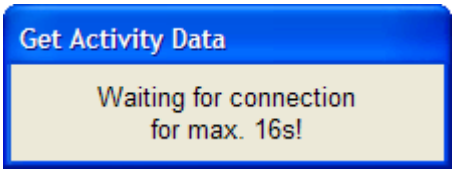

Figure 62: Activity read data connection window

After connection has been established, a save file dialog will appear and you can select a file name in which the activity data will be stored. By default it will be stored in the folder GPS_Plus\GPS Data (based on the base data path) and the default file name will be "`ACT_Collarxxxxx_YYMMDDHHMMSS.ADF`", where xxxxx is the 5-digit collar ID, followed by year (Y), month (M), day (D), hour (H), minute (M), and second (S) of export. Then the main window for the download will appear (Figure 61).

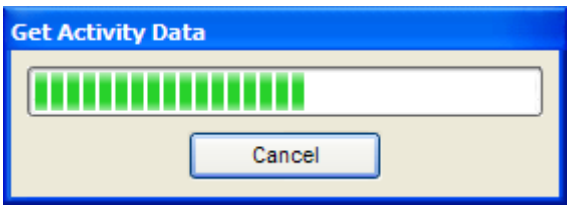

Figure 63: Reading activity data progress bar window

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The progress bar will not start immediately after the window appeared. Depending on the number of measurements stored in the collar the download will end before the progress bar reached the end. If you choose to cancel the download, all data received until this moment will be stored in the file.

4.3.2 Export Activity Data

This command can also be accessed via the toolbar symbol shown to the left. Please refer to 4.2.2 Export GPS Data, because it is quite similar, except for a few differences: You cannot export to GPX, KMZ, and KML, and the download may contain GSM/Iridium quality data (RSSI Received Signal Strength Indicator and BER Bit Error Rate). The GSM/Iridium quality data will be separated from the activity data and stored in a separate file.

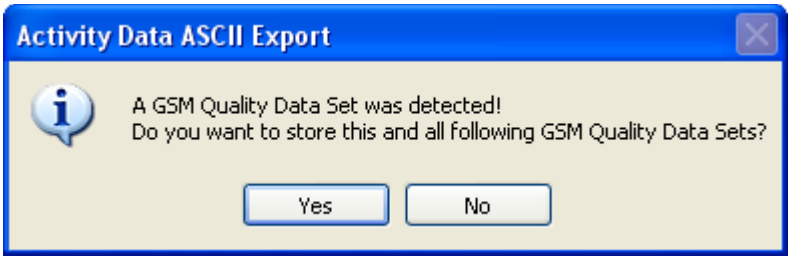
Activity Data ASCII Export
A GSM Quality Data Set was detected!
Do you want to store this and all following GSM Quality Data Sets?
Yes
No

Figure 64: A GPS quality data set has been detected

If a GSM/Iridium quality data set has been detected wile exporting activity data, a window will pop up (see Figure 64) asking if the GSM/Iridium data should be stored. If you answer no, GPS quality data will be ignored for the current download. If you answer yes, a save file dialog window will open and you can select a file name for the GSM/Iridium data. An example for the resulting GSM/Iridium quality file is given in Figure 65. UTC date and time give the time in Universal Time Coordinated, while LMT date and time give it Local Mean Time depending on the value set in UTC correction of the options form (see 3.1.8.10 Miscellaneous Tab Sheet). RSSI is the signal strength that was measured while transmitting an SMS and BER is the Bit error rate, which is calculated from the last communications (establishing the link to the service centre, etc). GSM/Iridium quality data is always exported as ASCII, regardless of the selected export mode.

```
UTC Date   UTC Time LMT Date   LMT Time   RSSI   BER
dd.mm.yyyy hh:mm:ss dd.mm.yyyy hh:mm:ss   [dBm]  [%]
-------------------------------------------------------
01.11.2002 12:30:00 01.11.2002 13:30:00   -67   <0.2
01.11.2002 12:35:00 01.11.2002 13:35:00   -73   <0.2
01.11.2002 13:55:00 01.11.2002 14:55:00   -71   <0.2
01.11.2002 14:10:00 01.11.2002 15:10:00   -69   <0.2
```

Figure 65: GSM/Iridium quality data

An example for the resulting activity file should is given in Figure 66. UTC date and time give the time in Universal Time Coordinated, while LMT date and time give it Local Mean Time depending on the value set in configure time (see section 3.1.8.10). Activity X and Y

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are the accumulated counters of movements out of the horizontal position around the corresponding axis. Temperature is the temperature in the collar.

```
UTC Date   UTC Time LMT Date   LMT Time ActivityX ActivityY Temp
dd.mm.yyyy hh:mm:ss dd.mm.yyyy hh:mm:ss [°C]
-------------------------------------------------------------
21.09.2001 17:00:00 21.09.2001 18:00:00         0          0   26
21.09.2001 17:05:00 21.09.2001 18:05:00         0          0   24
21.09.2001 17:10:00 21.09.2001 18:10:00        32         10   22
21.09.2001 17:15:00 21.09.2001 18:15:00         8          0   26
21.09.2001 17:20:00 21.09.2001 18:20:00         2          0   27
```

Figure 66: Activity ASCII export data file format

4.3.3 Activity: View Data

This command can also be accessed via the toolbar symbol shown to the left. It displays (see Figure 67) the content of an activity data file saved on the PC from a collar or read from a Handheld Terminal. It always displays ten activity data sets. You can easily navigate through the data sets with keyboard and mouse.

First you need to select a file via the Load File button: A standard open file dialog will open with *.ADF as extension and the default directory for activity data selected. Alternatively you can drag & drop an ADF Data File from the windows explorer or any other source. After loading a valid Activity Data File (ADF) the first ten data sets will be displayed immediately. The file name is displayed in the windows title bar.

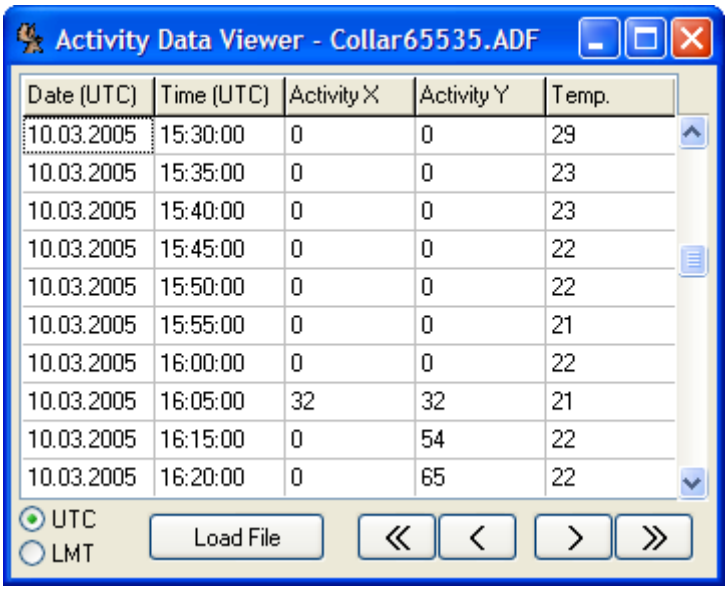

Figure 67: Activity Data Viewer with file loaded

The following information will be displayed: In the first column (with grey background), the number of the data set will be displayed. The next two columns display date and time which can be selected to be UTC or LMT in the lower left of the window. Then the two activity

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channels data is shown in the next two columns. They will be only displayed if you have a collar with the activity option selected. If one or both of the sensors are not available with your collar, N/A (not available) will be displayed instead of a value. The last column shows the corresponding temperature for that measurement.

To navigate through the data file you can use the buttons on the lower right. The double arrows (<< >>) jump back and forth 50 data sets, the single arrows (< >) only one data set. With the scrollbar, you can move easily through the data. Using the keyboard the cursor keys equal the single arrows, page up/down correspond to the double arrows. Home and End key move to the beginning and the end of the data file.

4.3.4 Activity: Show Chart

This command can also be accessed via the toolbar symbol shown to the left. It will display downloaded position data graphically. You can print and store the chart.

A window with an empty chart will appear (similar to Figure 56). You can load an activity file from the *File* menu via a file selection dialog. Alternatively you can drag & drop an ADF Data File from the windows explorer or any other source. Then data will appear in the chart, and the file name will appear in the windows caption (see Figure 69). Depending on the size of the data file this can take up to several minutes. The chart will automatically be scaled to show every point in the measured data. From the file menu you can easily save the chart as a Windows Meta File or a Bitmap. In case of Bitmap as format the chart will be stored as it is shown in the window because this is a pixel-oriented format. WMF stores it in a vector format, which is easily scalable; be aware that the text and data will also be scaled. Printing is even easier: Just press Print in the file menu and the chart will be printed in landscape on a selectable printer.

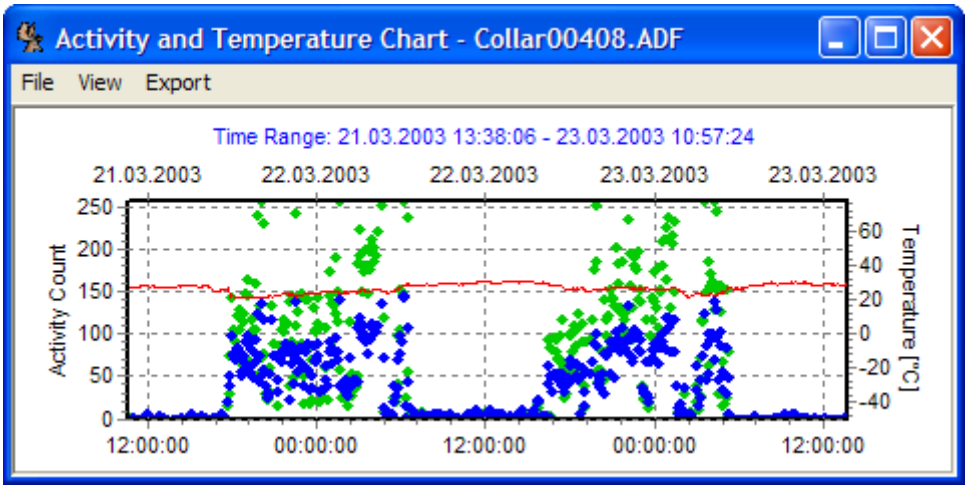

Figure 68: Activity and Temperature Chart window

You can zoom in by left clicking and dragging a square into the chart; it is important to click and drag from top left to bottom right. To zoom out left-click and drag left and down, then release. The chart will then be shown in its first appearance. Right-clicking and dragging

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moves the chart data. Right clicking only opens a pop up menu with *Zoom In*, *Zoom Out* (both by a factor of two), *Day*, *Week*, *Month*, *Year* and *All* to choose from. These commands are also available in the *View* menu.

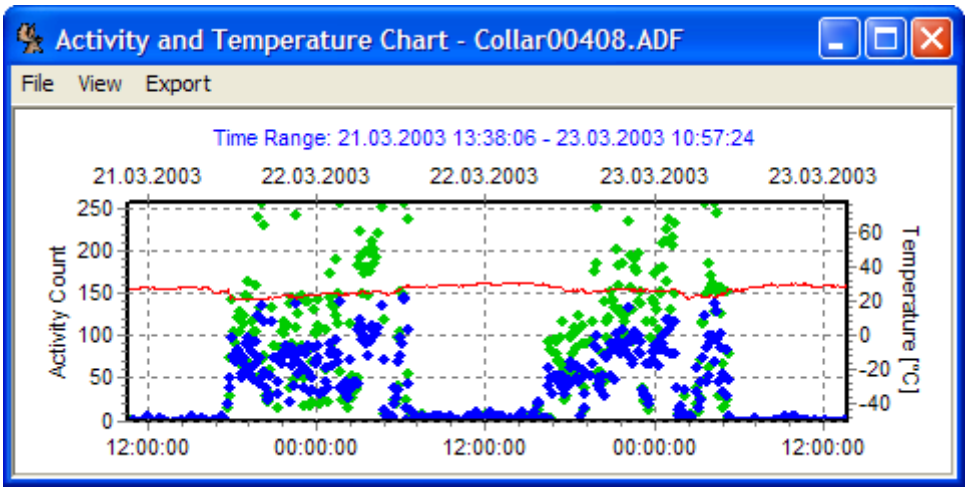

Figure 69: Activity and Temperature Chart window

Additionally, you can choose from the view menu which data shall be shown in the chart: Activity X, Activity Y and Temperature can selected to be visible or not. Data can only be displayed if the corresponding sensor or activity channel is enabled in the collar. Temperature is displayed as red line with the right axis as corresponding scale. Activity X is displayed as green diamonds and Activity Y as blue diamonds, the activity counts is given on the left axis.

You can export the loaded data to ASCII, spreadsheet, or database using the *Export* menu. You have two possibilities: *All Data* allows you to export data just like the standard export functionality but without selecting a source file since you already loaded the data. The second possibility, *displayed data*, allows you to export only the part of the data currently visible in the activity chart. To export an interesting part of the chart, just zoom into the chart until only the relevant part is visible, then select export displayed data.

4.3.5 Erase Activity Data

This is equivalent to 4.2.5 Erase Fix Data. Please refer to this description.

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4.4 Commands Menu

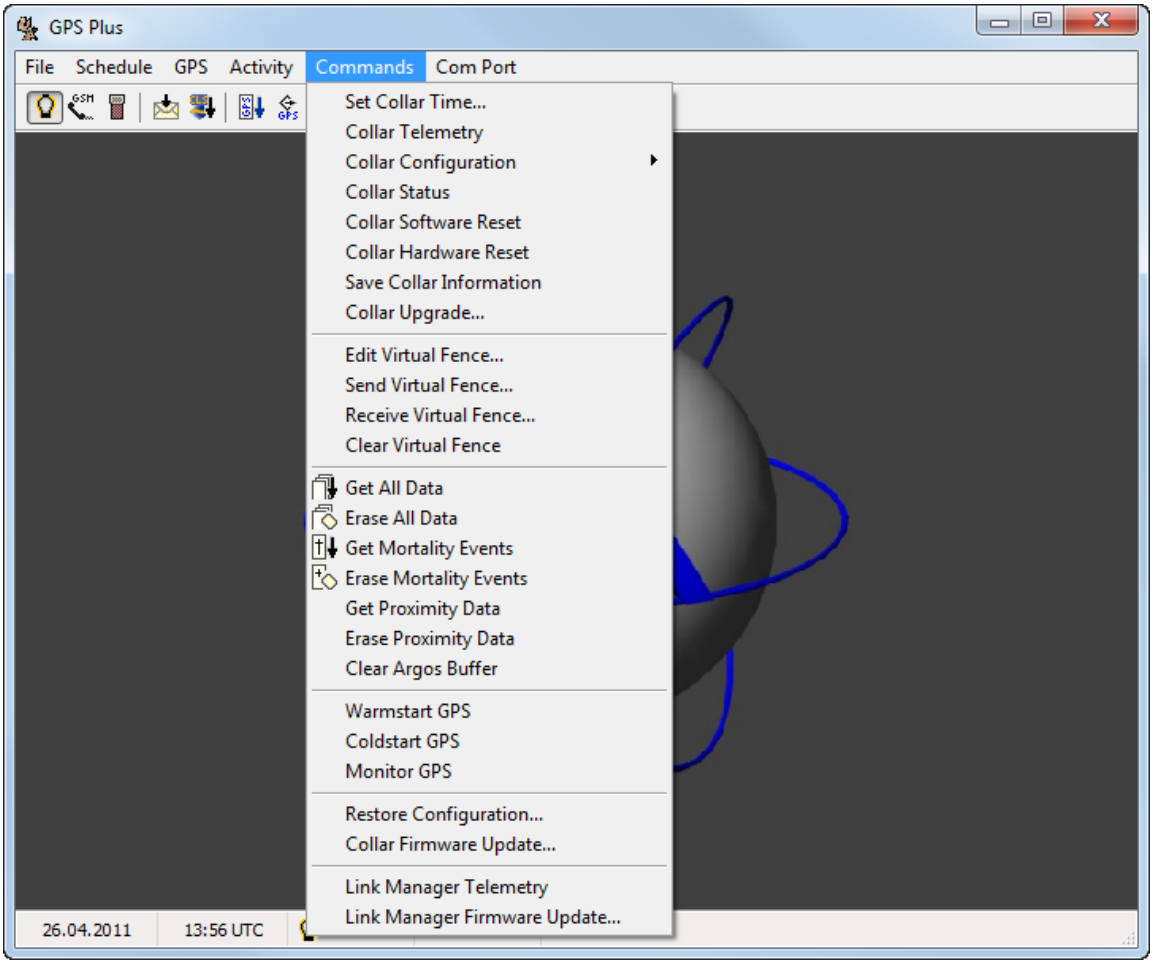

Figure 70: Main window with commands menu open (in Collar mode)

In the *Commands* menu are commands for the direct control of the collar and for collar testing.

4.4.1 Set collar time

To have the correct time and date after battery replacement it is important to set the correct time and date in every collar. The program suggest the time and date of the computer adjusted by the UTC correction configured in the options of GPS Plus (see 3.1.8.10 Miscellaneous Tab Sheet). You will notice that the displayed time continues to run. To change the time, click on the hours, minutes or seconds and then click on the up or down arrows. To change the date click on the drop down arrow and a calendar will open up; just select a date in the calendar. Finally, set the time by clicking the Set Time button. While GPS Plus contacts the collar, the time will continue internally until the moment in which the Collar Set Time command is send.

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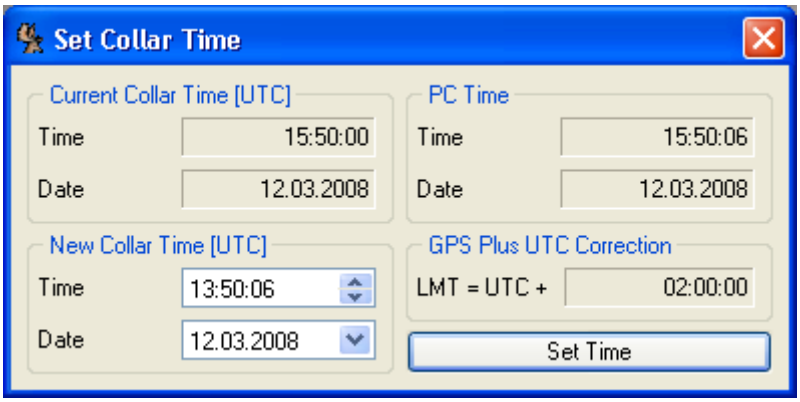

Figure 71: Set collar time window

With each GPS fix, the collar time is reset to the correct UTC time, corrected by your UTC correction (if enabled). It is thus not possible to synchronise the collar with another time, e.g. one running in your office, than the GPS satellite system's time. Also, UTC correction cannot be enabled by sending the local mean time to the collar.

4.4.2 Collar Telemetry

This command requests, receives, and displays collar telemetry data. While waiting for the connection with the collar, a window will open. After connection has been established the telemetry window with its five tabs (see Figure 72 and Figure 73) will appear. If the connection could not be established, an error message will appear.

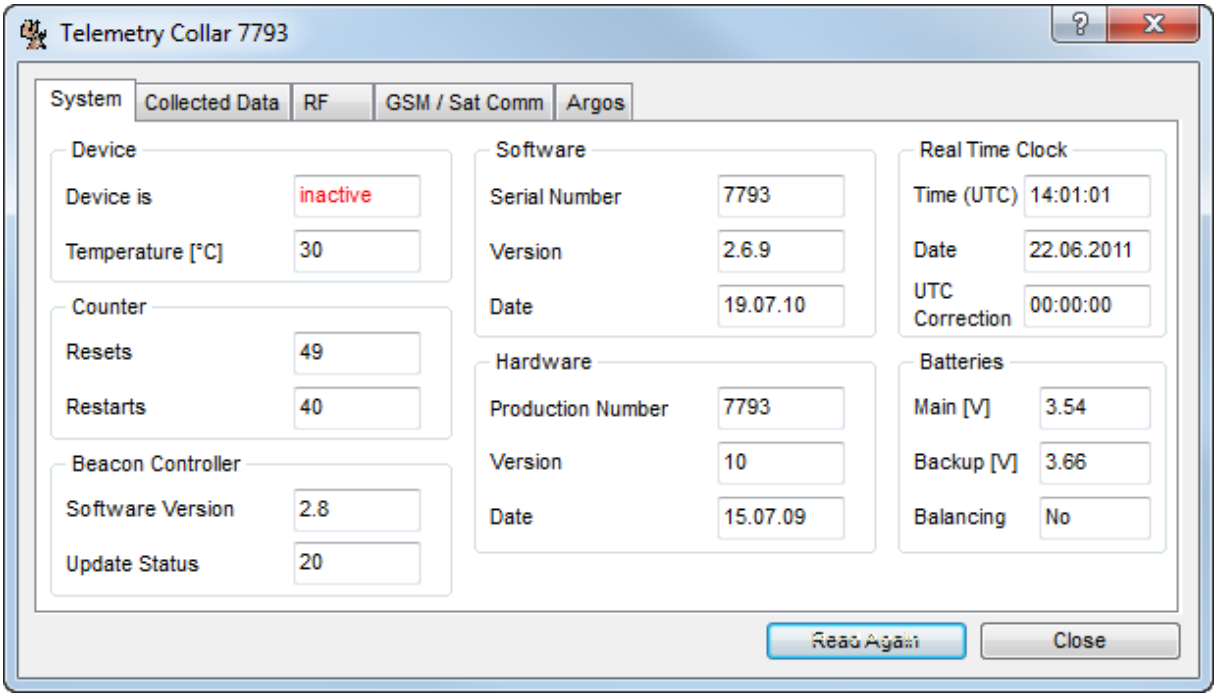

Figure 72: Telemetry window

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This window is mostly self-explanatory. For a brief description of the fields see Appendix B: Collar Telemetry Data Description. If you move your cursor on one of the data fields a brief explanation will be displayed. Clicking on New Telemetry requests a new set of telemetry data. Only data which apply to the collar's configuration and sensors are displayed. All other fields are disabled.

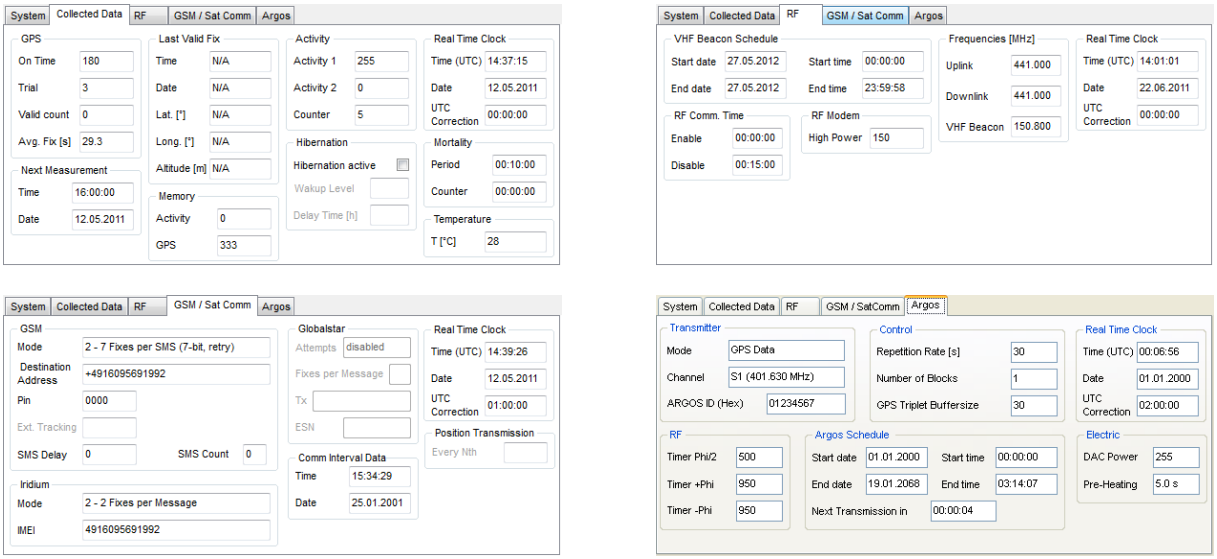

Figure 73: Tabs of the telemetry window

4.4.3 Collar Configuration

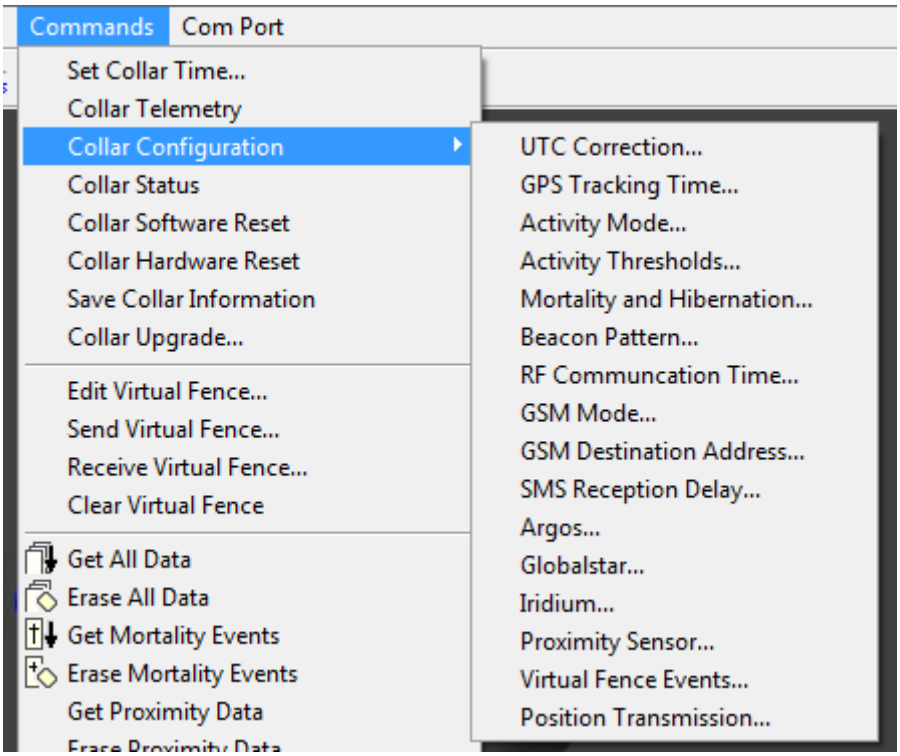

Figure 74: Collar Configuration Menu

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The collar has several user configurable features: Mortality and hibernation sensor, activity sensor, collar UTC correction, VHF beacon sound pattern, RF transmitter window, and communication parameter. In the *Collar Configuration* menu, you can read the current configuration and change it. This will only work with registered collars. After changing configurations, we advise to save a Collar Information file with *Save Collar Information* (see 4.4.7). It summarises all current settings of the collar and is a valuable information while the collar is on the animal or if you want to communicate with VECTRONIC about problems with a collar's performance.

You can refresh the current settings reading from the collar at any time by clicking the read button and write new settings with the write button. Only the features available with your collar will be enabled. The others will be disabled and are thus not changeable.

4.4.3.1 Time – UTC correction

For technical reasons, the collars will always run on UTC (Universal Time Code) which is also used by the GPS satellite system. You can enable the collar to calculate schedules with UTC Correction (Figure 75). In this case you can program the schedules in LMT (Local Mean Time) and the collar will correct the times according to the user-defined UTC correction. If you do not enable this option, UTC will be used.

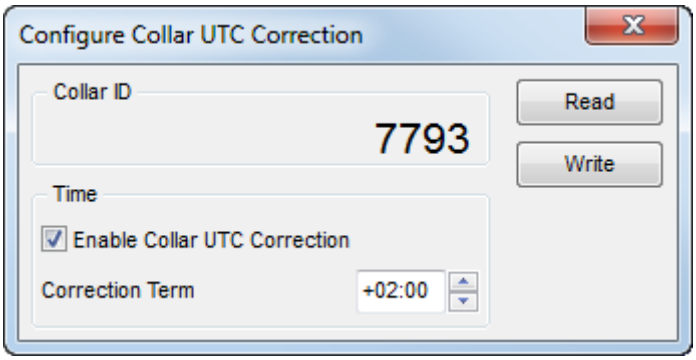

Figure 75: Configuration of UTC Correction

4.4.3.2 GPS Tracking Time

For each scheduled GPS fix, the GPS device of the collar will take several positions in a predefined time and store the most precise of these positions. To increase the accuracy of a position (and thus decrease its mean deviation), the tracking time of the GPS device can be extended for up to 45 seconds. Though this will increase the accuracy of the stored fix, it will also increase the energy consumption of the collar and can considerably decrease the collar's lifetime.

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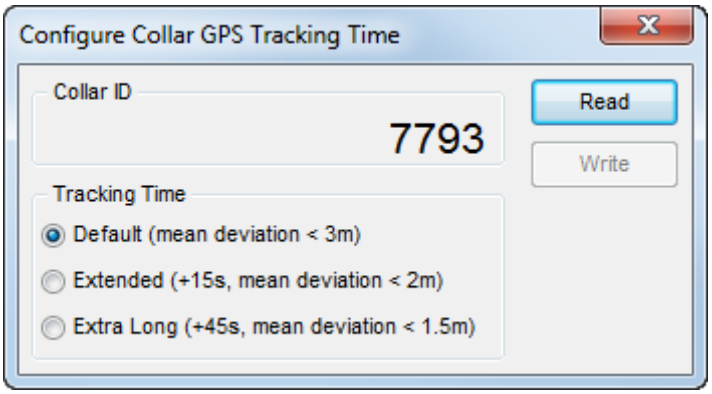

Figure 76: Configuration of GPS Tracking Time

4.4.3.3 Activity

Depending on your collar type and the firmware version, you can select different activity measurement modes (Figure 77).

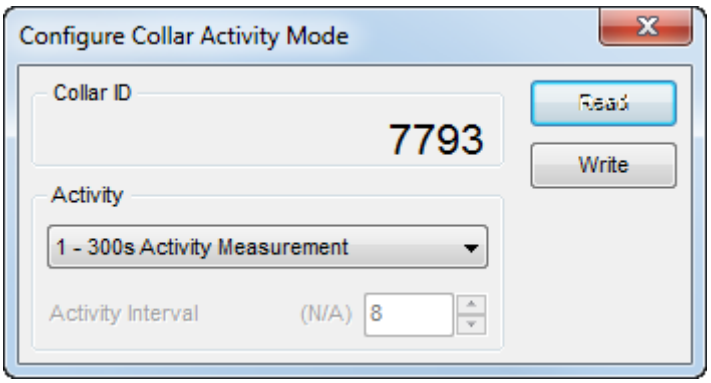

Figure 77: Configuration of Collar Activity Mode

1 – 300s Activity Measurement: The acceleration on the X and Y axis is stored in 296 s intervals, the time series is regularly corrected to 300 s intervals.

2 – 152s Activity Measurement: This mode measures activity over a sampling interval of 152 seconds.

3 – 64s Activity Measurement: This mode measures activity over an interval of 64 seconds; it is the smallest storing interval available.

4 – Activity Measurement: Accumulated activity is measured for a predefined interval; intervals can be chosen in 8 second steps.

5 – Head Angle / Acceleration Threshold: This mode measures two parameters and stores them in two channels:

1. Head Angle / Head up: Gives the ratio of measurements on the X axis within one sampling interval in which the head exceeds a user-defined angle towards the vertical axis.

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2. Acceleration: Gives the ratio of combined measurements on all three axes within one sampling interval in which the acceleration exceeds a user-defined threshold.

6 – Acceleration Peak / Acceleration Threshold: This mode measures two parameters and stores them in two channels:

1. The maximum acceleration measurements on all three axes within one sampling interval.
2. The ratio of acceleration measurements on all three axes within one sampling interval below and above a user-defined activity threshold.

7 – Forth Back/Up-Down: Acceleration is measured with two channels: channel 1 measures forward-backward motion, channel 2 measures head up/down motion.

The interval and the thresholds (if applicable) can be adjusted with the corresponding up-down control. The Interval is given in an "eight seconds unit", the thresholds are without unit and have a range from zero to 255.

If you change the activity mode, all activity data will be erased from the collar. This avoids the mixture of data measured with different activity modes.

4.4.3.4 Activity Threshold

Appropriate values for Modes 5 and 6 - can be selected with the Activity Monitor (see Figure 78), which can be activated by clicking on the Display Test Measurement button.

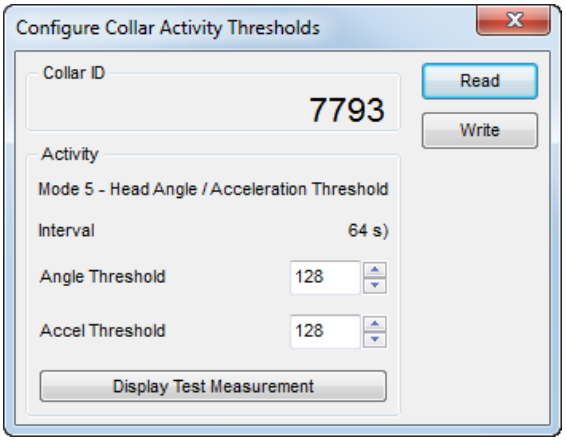

Figure 78: Configuration of Activity Threshold

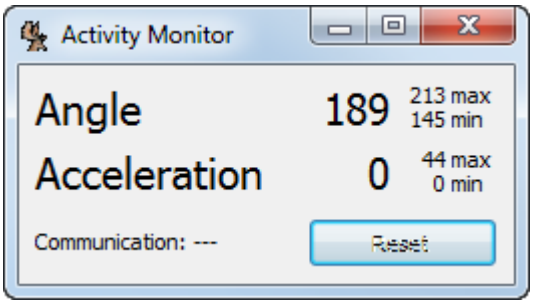

Figure 79: Activity Monitor for testing threshold values

While the window will show up immediately, it will take some time until the first measurements arrive. Move the collar in a way you assume the animal will move to determine an appropriate threshold. Adjust the threshold in the configuration form to these values.

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4.4.3.5 Mortality and Hibernation

Mortality period is the time with no detected movement of the animal, after which a mortality event is stored in memory and the collar enters mortality mode (depending on the model). This is of course only done if the collar is capable of mortality events. Otherwise this time has no effect.

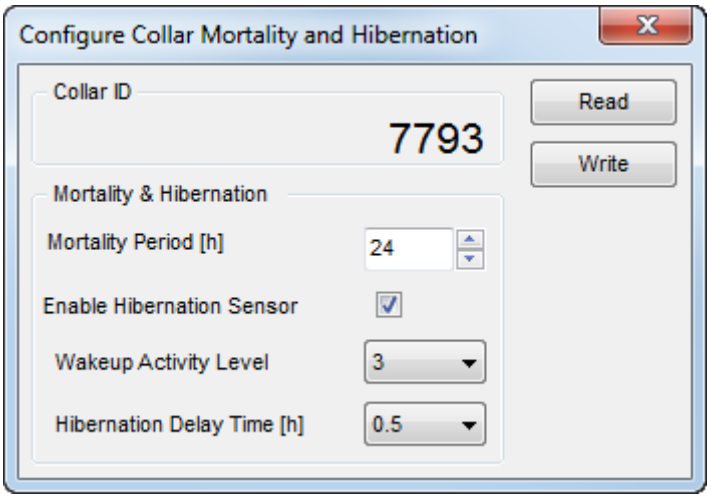

Figure 80: Configuration of Mortality and Hibernation

If "Enable Hibernation Sensor" is checked, the activity sensor will be used for the hibernation mode. In hibernation mode no attempts will be made to get a GPS fix. This will extend the operating time of your collar if the tracked animal goes into hibernation in a cave or similar. Wakeup is the level of activity, which stops the hibernation mode and brings the collar back into normal operation. Hibernation Delay Time is the time after that hibernation mode is entered if the activity is below the Wakeup Activity Level.

4.4.3.6 VHF Beacon Pattern

This option allows you to change the sound pattern of the collars VHF beacon, if the collar is equipped with a VHF beacon transmitter. You can choose from four different patterns. Listen to the pattern by clicking on the speaker button.

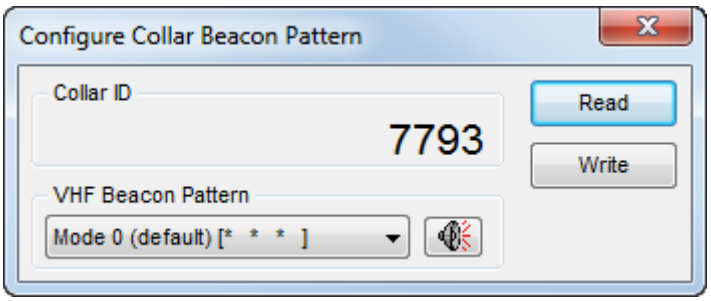

Figure 81: Configuration of VHF Beacon Pattern

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4.4.3.7 RF Communication Time (VHF or UHF collars only)

Communication enable time and Communication disable time define the times when the VHF or UHF data communication will go into standby (enabled: reception possible) and when it will be switched off (disabled: no communication). You can also select an enable time that is "later" than the disable time. The VHF/UHF communication module will be enabled at the given time and disabled at the next day on the disable time. Depending on the collar's UTC correction the time is interpreted as UTC or LMT.

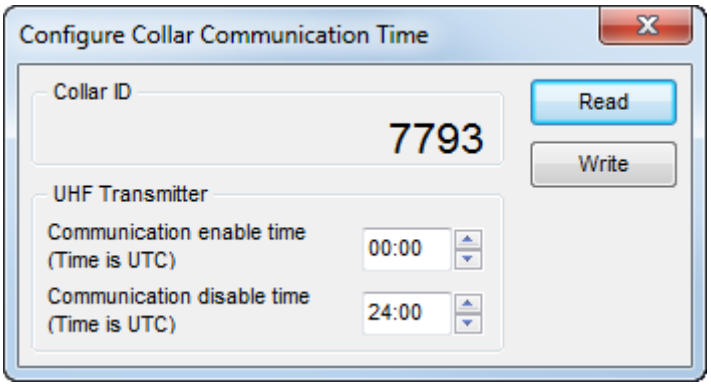

Figure 82: Configuration of RF Collar Communication Time

4.4.3.8 GSM Mode (GSM collars only)

This command allows you to change the GSM mode of your collars. The GSM mode defines how many data sets are transmitted with one SMS message and what kind of coding is used (6-bit or 7-bit). **Changing the coding can make your collar incompatible with your GSM provider**. The program will warn you if you are about to change the coding. Changing the number of fixes per SMS may degrade the lifetime of your collar since less data sets per SMS will lead to more SMS messages which will consume more power. However, less data sets per message will also lead to faster information about the collars position.

The form (Figure 83) consist of two parts. The upper part displays the collar ID, the collar's Destination Address, and the Current GSM Mode. You cannot change anything here. In the lower part, you can choose the New GSM Mode from a drop down list.

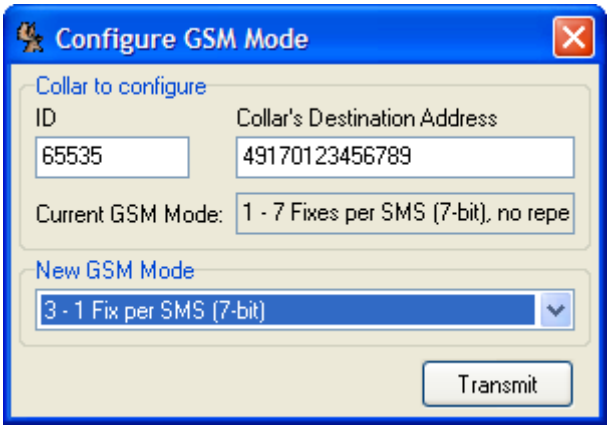

Figure 83: Configure GSM Mode directly in the collar

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4.4.3.9 GSM Destination Address (GSM collars only)

This command allows you to change the destination address of a GSM collar. This is the phone number to which the collar will send its SMS messages. The form (Figure 84) consists of two parts. The upper part gives the ID and current Destination Address. You cannot After entering the new number, click on Transmit to send the new number to the collar. You will receive an acknowledgement message when operation was successful.

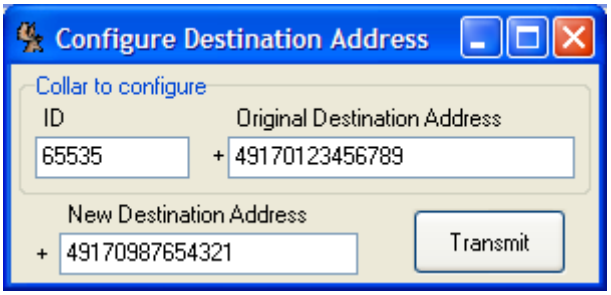

Figure 84: Configure Destination Address directly in the collar

4.4.3.10 SMS Reception Delay (GSM collars only)

By default, the collar's GSM modem will switch on to send an SMS, listen to incoming messages immediately after all SMS have been sent, and switch off again. To increase the chance that the collar can receive new schedules or commands in real time, immediately after it has transmitted the GPS location, you can delay the interval for SMS reception. You can change the SMS Reception Delay in steps of eight seconds. The modem will stay switched on for this time to listen. Please note that the SMS reception delay will shorten the lifetime of your collar.

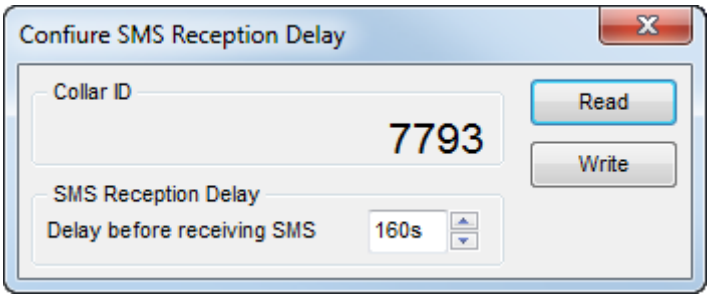

Figure 85: Configuration of SMS Reception Delay

4.4.3.11 Argos Transmitter

Configuring the Argos transmitter includes the following values:

Argos Channel: This is the frequency of your collar's Argos transmitter for location and transmission services via Argos. The frequency is provided by Argos.

Argos ID: This is the **hexadecimal** identification code of your collars Argos transmitter. **Everywhere else in the program the decimal ID code is used.** It is provided by Argos.

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Repetition Rate: Defines the interval in which Argos messages are transmitted. You can make suggestion to Argos but they set the value according to an internal optimisation.

Number of Blocks : Defines the number of 32-bit blocks per message. This value has to be eight if you are transmitting GPS positions via Argos. If you are using location service by Argos, adjust to the value provided by Argos.

GPS Triplet Buffer Size: Defines the size of a ring buffer storing the last multiple of three GPS positions scheduled for transmission via Argos.

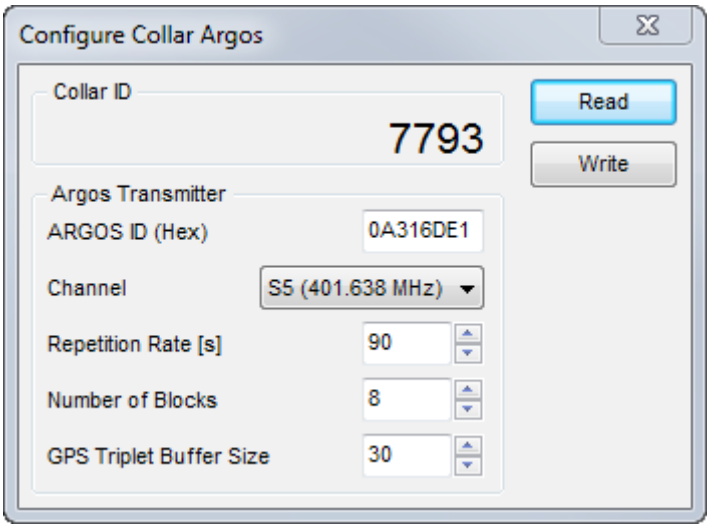

Figure 86: Configuration of Argos transmission

4.4.3.12 Globalstar

You can configure two parameters of the Globalstar communication:

Transmission Mode: Defines how many fixes are being transmitted. Mode 0 means that every fix is transmitted, while for example mode 3 means that only every fourth fix is transmitted. The remaining fixes can be downloaded after retrieving the collar or with the VHF data communication (if available in the collar).

Fixes per Message: Defines how many fixes are transmitted in one Globalstar message. You can transmit one or two fixes per message.

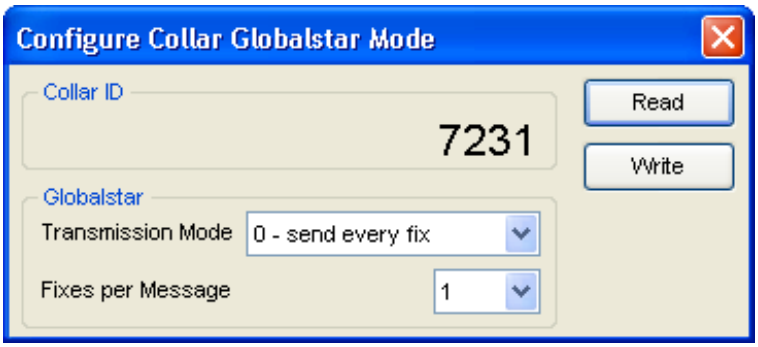

Figure 87: Configuration of Globalstar transmission

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By combining both settings, you can affect the number of positions transferred by Globalstar, i.e. the configuration Mode 3, 2 fixes per message result in the transfer of two fixes being sent, and two fixes being stored in the non-volatile collar memory only.

The satellite reception success rate increases with reduced length of the message. Hence the "1 fix per message" mode has a higher satellite reception rate than the "2 fix per message" mode.

4.4.3.13 Iridium

Iridium Mode controls the number of positions per transmitted message. The more positions per message, the less energy is consumed. The less positions per message, the higher the update rate of positions at the base station.

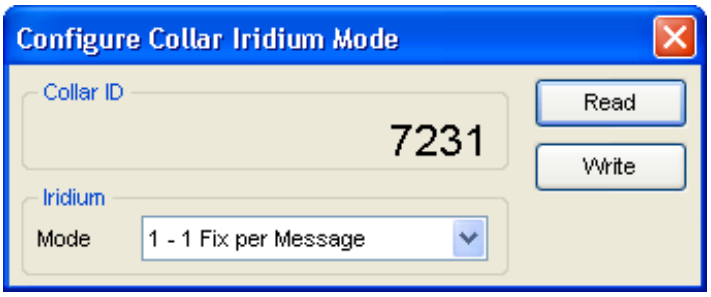

Figure 88: Configuration of Iridium transmission

4.4.3.14 Proximity Sensor (UHF collars only)

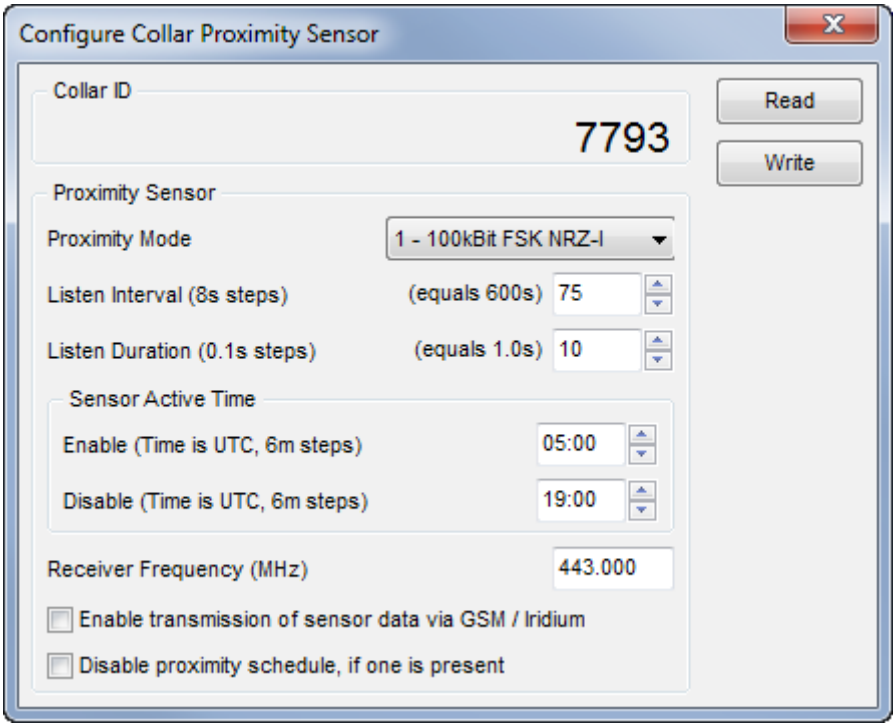

Figure 89: Configuration of Proximity Sensor

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You can configure an interval in which the proximity sensor is switched on and listening to the VECTRONIC UHF ID tags (Listen Interval) for a given Listen Duration. Additionally, you can define a time period during the day in which the Listen Interval is applied (Sensor Active Time). The Receiver Frequency is defined by VECTRONIC and must not be changed.

Check Enable transmission of sensor data via GSM / Iridium to receive the proximity events remotely. To disable an uploaded Proximity GPS schedule, check Disable proximity schedule, of one is present. If you want to use a proximity schedule again, simply upload a new proximity schedule to the collar (via USB, VHF, GSM or Iridium interface).

4.4.3.15 Virtual Fence Events (GPS Plus collars only)

If you are using a Virtual Fence, you can configure the collar to send you a message per GSM or Iridium after the collar has been located for the first time inside the Virtual Fence and/or after it has been located for the first time again outside the Virtual Fence. To ensure that you will receive the message, you can set a Retransmit Interval, which defines the time in minutes after which the message will be sent a second time.

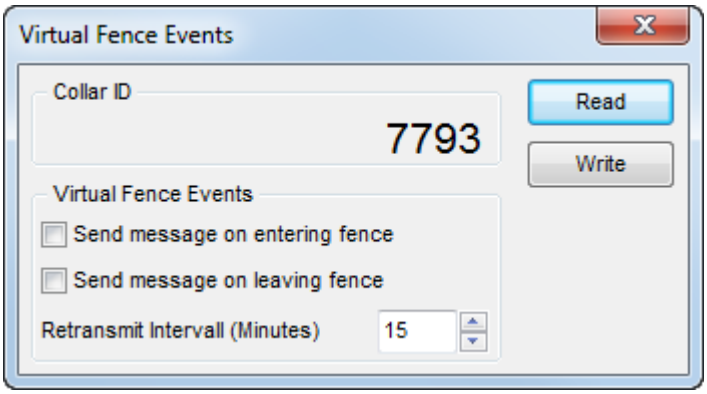

Figure 90: Configuration of Virtual Fence Message

4.4.3.16 Position Transmission

With GSM and Iridium collars, you do not need to transmit every position, but instead only every second, third, fourth etc. The highest value is every 16th position. All positions obtained by the collar are stored in the collar's memory and can be downloaded via VHF/UHF radio link or Link Manager. By skipping positions, you can save energy and money for transmission, especially if you have short GPS intervals.

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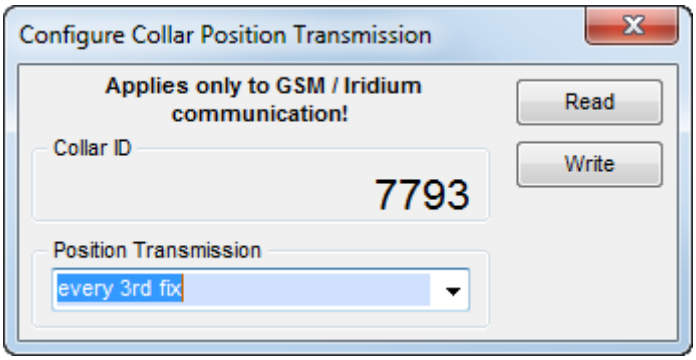

Figure 91: Configuration of Position transmission

4.4.4 Collar Status

This listens to the collar's interface and gives information on the current task performed by the collar. On starting this command, an empty window will appear (Figure 92). Every time the connected collar transmits its status, the time, the code and the meaning of the code are displayed. The update frequency depends on the current mode of the collar. For example in standby mode the collar should transmit its status every eight seconds, in GPS Fix mode it varies between one and several seconds.

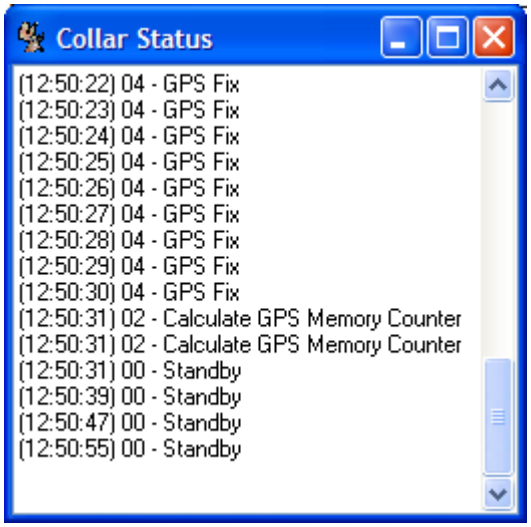
Collar Status
(12:50:22) 04 - GPS Fix
(12:50:23) 04 - GPS Fix
(12:50:24) 04 - GPS Fix
(12:50:25) 04 - GPS Fix
(12:50:26) 04 - GPS Fix
(12:50:27) 04 - GPS Fix
(12:50:28) 04 - GPS Fix
(12:50:29) 04 - GPS Fix
(12:50:30) 04 - GPS Fix
(12:50:31) 02 - Calculate GPS Memory Counter
(12:50:31) 02 - Calculate GPS Memory Counter
(12:50:31) 00 - Standby
(12:50:39) 00 - Standby
(12:50:47) 00 - Standby
(12:50:55) 00 - Standby

Figure 92: Collar status window

There are five collar statuses that can be displayed:

00 - Standby
01 - Calculate Activity Memory Counter
02 - Calculate GPS Memory Counter
03 - Auto Page Rewrite
04 - GPS Fix:
05 - GSM Idle
06 - GSM Active

All other IDs will be displayed as unknown status. If the status window is flooded with messages, most of them unknown, you probably have done a Warmstart GPS or a Coldstart GPS (see 4.4.19 and 4.4.20) before; the collar now transmits GPS data. Just wait until it finishes the fix; this may take a few minutes. Only the last 100 status messages are displayed. If more than 100 messages are received, the oldest is erased.

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4.4.5 Collar Software Reset

The collar will initialise itself and recalculate the next measurement time. You will be informed that the program is trying to connect to the collar. After connection has been established the command will be executed. If the connection could not be established an error message will appear and the command is aborted.

4.4.6 Collar Hardware Reset

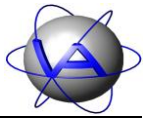
This command should only be used if it is really necessary to reset the collar. A collar hardware reset command is send to the Link Manager. The Link Manager will trigger the reset line of the collar. Unlike the Software reset, this is not a command to the collar. Because of that it can also be used if the collar does not respond to commands any more. You will be informed while command is executed. If the command was unsuccessful, an error message will appear.

4.4.7 Save Collar Information

With this command you can store the configuration data of the connected collar. After connection with the collar has been established, a *Save File* dialog will open. You can change the default name and path to your needs. The file will look similar to what you can see in Figure 93.

```
Information File of Collar No.  07793
Date of Readout: 22.06.2011, 16:51:17
GPS Plus Version:           3.9.1.860
-------------------------------------
Collar Date (UTC):     22.06.2011
Collar Time (UTC):     14:52:21

Software Version:      2.6.9
Serial Number:         7793
Software Date:         19.07.10

Hardware Version:      10
Production Number:     7794
Production Date:       15.07.09

Beacon Software Vers.: 2.8
Beacon Update Status:  20

Temperature logging:   1 - ON
Activity Mode:         4 - Activity Measurement
Activity Interval:     288s
Angle Threshold:       N/A
Accel. Threshold:      N/A

Mortality logging:     1 - ON
Mortality Period:      00:10:00

Hibernation is:        Enabled
Hib. Wakeup Level:     3
Hib. Delay Time:       0.5 h
```

```
Uplink Frequency:       441.000 MHz
Downlink Frequency:     441.000 MHz
UHF Beacon Frequency:   441.000 MHz

UHF Beacon On Time:     05:00 min
UHF Period:             2.0 s

Com Enable Time:        07:15:00
Com Disable Time:       19:30:00

VHF Beacon Frequency:   150.800 MHz
VHF Beacon Pattern:     Mode 0 (default) [*   *   *   ]

Argos Mode:             No Argos
Argos Channel:          N/A
ArgosID:                N/A

Argos Repetition Rate: N/A
Argos No of Blocks:     N/A
Argos Buffer Size:      N/A

Argos DAC Power:        N/A
Argos Pre-Heating:      N/A

Argos Timer Phi/2:      N/A
Argos Timer +Phi:       N/A
Argos Timer -Phi:       N/A

Iridium Mode:           10 - 10 Fixes per Message
Iridium IMEI:           30003401xxxxxxx

Globalstar Attempts:    (disabled)
Fixes per Message:      N/A
Transmission Mode:      N/A
Globalstar ID:          N/A

GSM Mode:               0 - No External Communication Module
Destination Address:    N/A
GSM PIN Number:         N/A
SMS Reception Delay:    N/A

Collar UTC correction: Not Active
Correction term:        N/A

Proximity Sensor:       Enabled
Prox. Interval:         304 seconds
Prox. Duration:         1.5 seconds
Prox. Enable Time:      00:00:00
Prox. Disable Time:     24:00:00
Prox. Mode:             1 - 100kBit FSK NRZ-I
Prox. Frequency:        443.000
Prox. Transmission:     Disabled

Next Comm. Time:        14.07.2000 16:57:40

Message on VF enter:    No
Message on VF leave:    No
Retransmit Interval:    0 minutes

GPS Mode:               Solved
GPS Schedule is:        not locked
GPS Schedule:
01.01.2000 - 17.06.2033 & 16:00:00 - 23:59:58 # 01:30:00
01.01.2000 - 17.06.2022 & 01:00:00 - 07:00:00 # 01:30:00
01.01.2000 - 17.06.2024 @ 12:00:00
```



```
UHF Schedule:
 N/A

VHF Schedule:
01.01.2000 - 16.06.2020 & 06:00:00 - 09:00:00 # 00:00:00
01.01.2000 - 16.06.2018 & 15:00:00 - 19:00:00 # 00:00:00

Argos Schedule:
01.01.2000 - 01.05.2011 (loop duration: 1 days, 00:00:00 hours
  01: offset: 0 days, 00:00:00 hours; duration: 1 days, 00:00:00 hours

Proximity Schedule:
20.12.2010 - 20.12.2011 & 00:00:00 - 23:59:58 # 00:05:00

GSM Schedule:
<?xml version="1.0" encoding="UTF-8"?>
<gsmSchedule time="2011-06-22T16:51:18Z" creator="GPS Plus - http://www.vectronic-
aerospace.com">
  <rule stop="2026-06-17T06:10:00Z" start="2000-01-01T06:05:00Z"
period="P1DT0H0M"/>
</gsmSchedule>


Virtual Fence Collection:
<?xml version="1.0" encoding="UTF-8"?>
<virtualFenceCollection time="2011-06-22T16:51:18Z" creator="GPS Plus -
http://www.vectronic-aerospace.com">
  <virtualFence name="Fence 0">
    <insidePoint name="" latitude="0.00000" longitude="0.00000"/>
    <post id="0" name="Post 0" latitude="0.99999" longitude="0.00000"/>
    <post id="1" name="Post 1" latitude="0.00000" longitude="0.99999"/>
    <post id="2" name="Post 2" latitude="-1.00001" longitude="0.00000"/>
    <post id="3" name="Post 3" latitude="0.00000" longitude="-1.00001"/>
  </virtualFence>
</virtualFenceCollection>

Virtual Fence Schedule:
01.01.2000 - 22.06.2039 & 00:00:00 - 23:59:58 § 00:15:00
```

Figure 93: Sample collar information file

4.4.7.1 Collar Upgrade

This command allows you to activate options of your collar by uploading a collar upgrade file (.CUF) for one specific collar. Connect the collar you want to upgrade to your link manager and select the command Collar Upgrade. Select the collar upgrade file with the corresponding collar ID and the desired upgrade option; Collar65535_Mortality.CUF for example enables the mortality sensor of collar 65535. When you select Open , the upgrade file will be sent to the collar. While this is done you will see a message window with a disabled OK button. It will change its text and enable the button when the upgrade is finished.

Upgrade will only work for registered collars! See 3.1.6 Collar List for details on how to register a collar.

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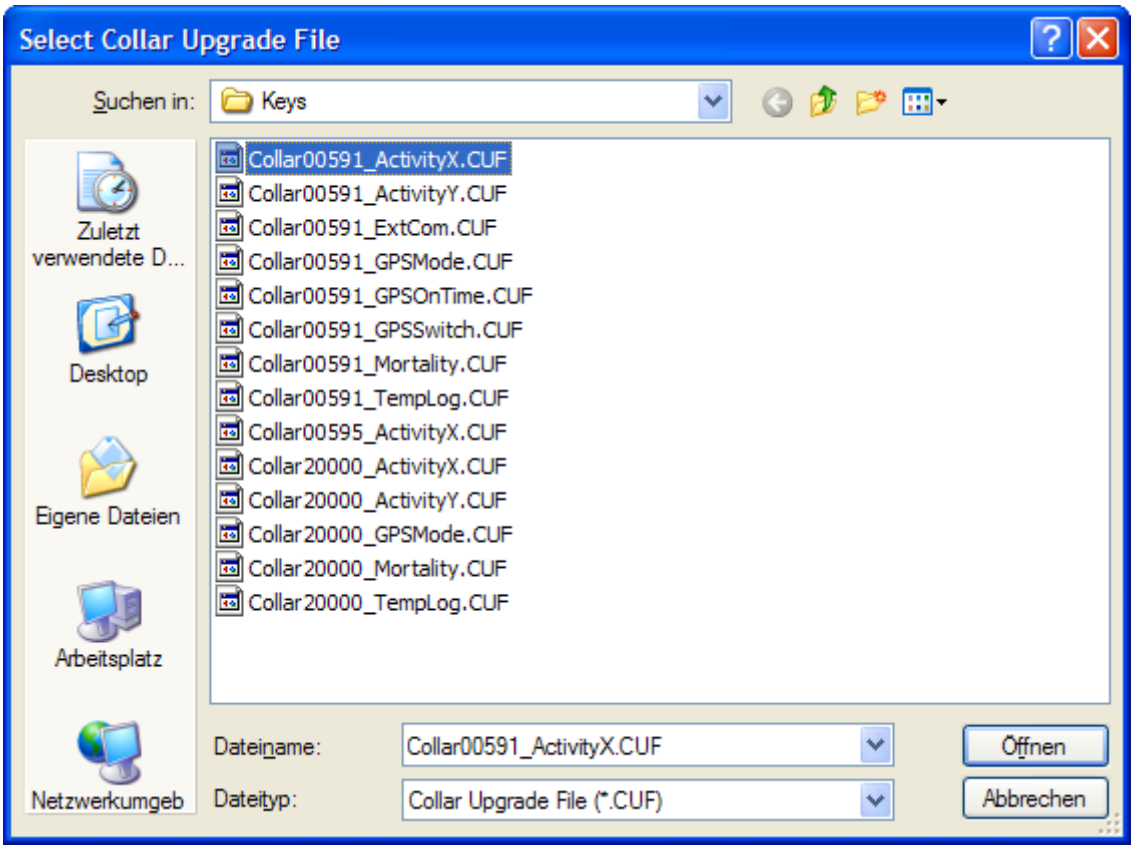

Figure 94: Select collar upgrade file dialog

4.4.8 Edit Virtual Fence

The virtual fence allows you to automatically use different GPS schedules in different areas. You can define a special schedule that is activated if a fix is done in a defined area and deactivated when a fix is done outside this area.

To create or edit a virtual fence, open the Edit Virtual Fence menu item. There you have several options to create a virtual fence. The first option requires a list of latitude longitude (WGS84) coordinates of a polygon. You can imagine each position as fence posts between which the fence is spanned as a straight line. You also need one point with coordinates clearly inside the polygon. This data is then entered in the form and displayed as a graph on the right. The other option is to create a polygon in Google Earth, save it as a .KML file and import it into the virtual fence editor. A fence can also be exported into Google Earth.

The Virtual Fence Editor form (Figure 95) consists of three parts: At the top is the menu and toolbar, the left shows the coordinates of the fence posts and on the right is an approximate display of all fences. Below the toolbar are tabs listing the defined fences of the Virtual Fence Collection. At the bottom are two fields: The first shows the file name of the current fence collection and if it is unsaved. The second show the binary size of the fence collection. This is important if you want to send the fence collection to a collar that is not connected via cable.

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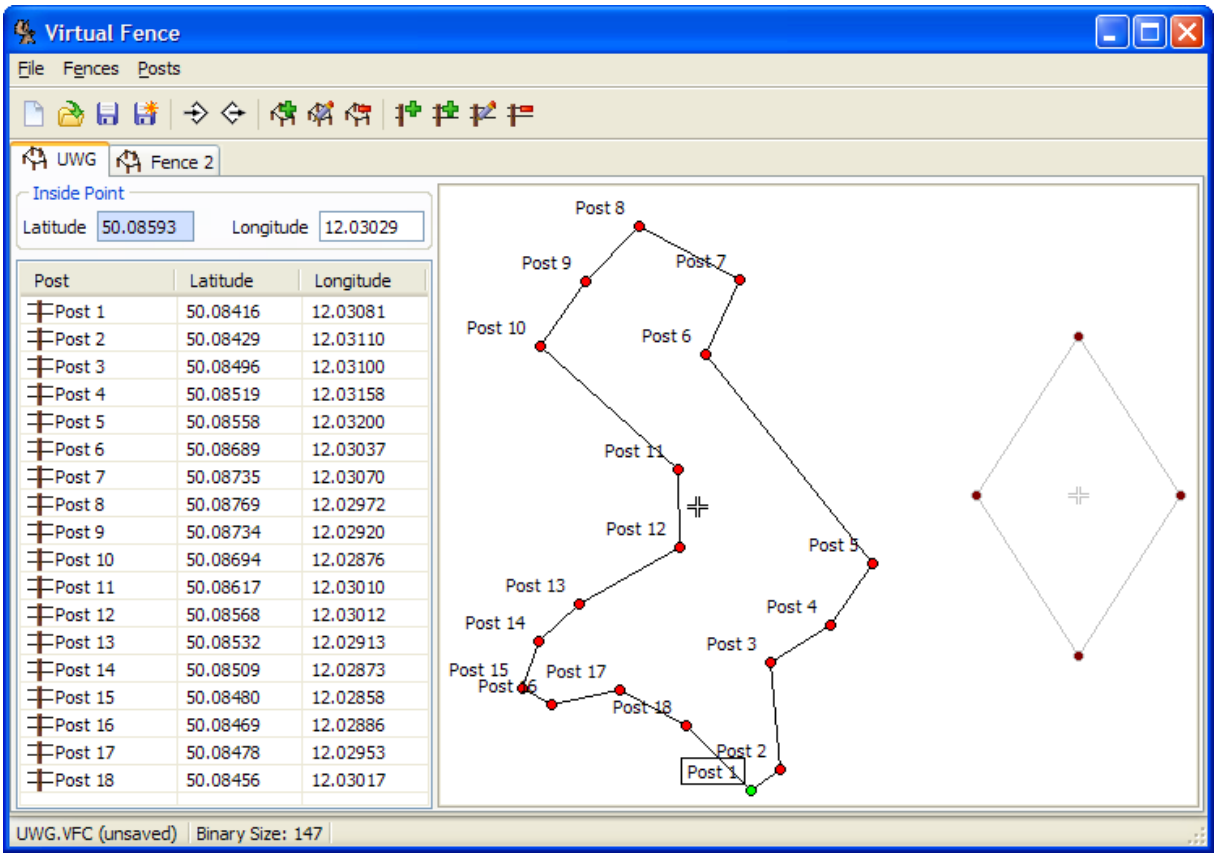

Figure 95: Virtual fence collection in editor with two fences ("UWG" and "Fence 2"). The black lines indicate the fence on the current tab ("UWG"), the grey lines indicate the fence on the other tab ("Fence 2").

Import KML polygon as Fence: You can import a polygon created in Google Earth from a KML file into GPS Plus. You can do this by clicking on the item or the Import Fence... command from the *Files* menu. The name of the file will be the name of the fence. If you have multiple polygons in the .KML file, only the first will be imported. The necessary *Inside Point* is automatically set to the geometric centre of all posts (Note: This is not necessarily inside the polygon).

Export Fence as KML polygon: To check your fence in Google Earth, you can export it as .KML file and open it in Google Earth by clicking on the icon or selecting the Export Fence... command from the *Files* menu.

Add a Fence: You can add a fence to the fence collection by clicking on the icon or calling the Add Fence... command in the *Fences* menu. The initial fence will always be created as a diamond shape with two degrees across placed at the equator and the zero meridian. Every other fence will be created at the average of all posts of the already existing fences.

Edit Fence name: The currently selected fence can be renamed with this option. Click on the icon or use the Edit Fence... command in the *Fences* menu.

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Remove Fence: The currently selected fence will be removed from the Fence Collection. You will be asked for a confirmation before this command is executed. Click on the icon or use the Remove Fence... command in the *Fences* menu.

Append Post: Appending a post will add a post to the end of the list of the current fence. A dialogue will open where you have to enter a name for the post (by default "Post x") and the coordinates. Click on the icon or use the Remove Fence... command in the *Posts* menu.

Insert Post: Inserting a post will only work if another post from the list is selected. A new post will be inserted before the currently selected post just like appending a post if you click in the icon or select the Insert Post command in the *Posts* menu.

Edit Post: You can edit each fence post by double clicking on it, by clicking on the icon, or by clicking on the Edit Post command in the *Posts* menu. The dialog is the same as the append/insert post dialog.

Remove Post: The currently selected post will be removed without further confirmation if you click on the icon or by selecting the Remove Post command in the Posts menu.

To rearrange posts, you can drag & drop them in the list of the current fence.

4.4.9 Send Virtual Fence

To configure a collar with a Virtual Fence Collection you need to send the collection and a schedule that will be used while the collar is located as inside the fence. The dialog allows you to select two files: A fence collection and a GPS schedule. After selecting a file, supplementary information is displayed regarding the file. Both are shown as valid, invalid, or too large. For the Fence Collection, you can see the number of fence, the overall number of posts, and the number of bytes the Fence Collection will need. For the GPS schedule, the number of rules and the number of bytes needed is shown (see Figure 96). The maximum number of bytes for a Fence Collection is 385 bytes and 490 bytes for the associated GPS schedule.

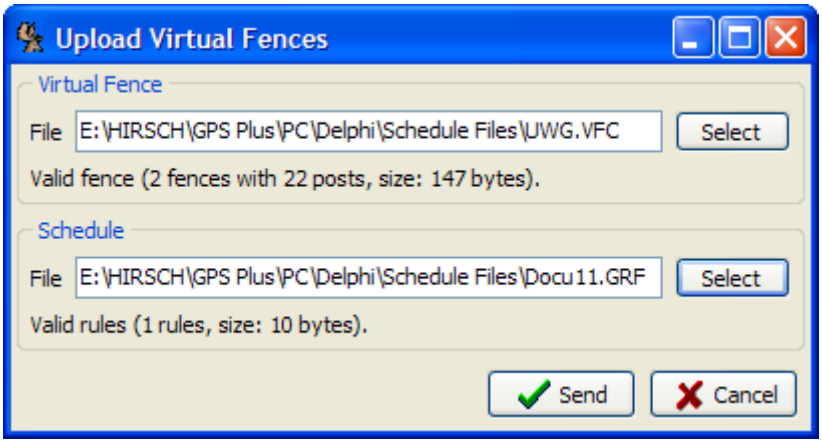

Figure 96: Upload Virtual Fences dialog with loaded files

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4.4.10 Receive Virtual Fence

To read the Virtual Fence currently active on a collar, use the Receive Virtual Fence command. It will request the files names of the Virtual Fence Collection and the associated GPS schedule. You can then view them with the Virtual Fence Editor and the Schedule Editor accordingly.

4.4.11 Clear Virtual Fence

To disable the virtual fence function, you need to clear the Virtual Fence Collection and its associated GPS schedule. The Virtual Fence Collection will be erased immediately with this command, no confirmation will be requested.

4.4.12 Get All Data

This command is equivalent to 4.2.1 Get Fix Data, 4.3.1 Get Activity Data, and 4.4.14 Get Mortality Events, but all three commands will be executed one after the other.

4.4.13 Erase All Data

This command is equivalent to 4.2.5 Erase Fix Data, 4.3.5 Erase Activity Data, and 4.4.15 Erase Mortality Events, but all three commands will be executed one after the other. You will have to confirm that you want to erase all data. After your confirmation, you have 20 seconds to abort the command. After that, data will be erased completely, it is not possible to terminate the process. **There is no way to restore erased data on the collar!**

4.4.14 Get Mortality Events

If the collar is capable of storing mortality events you can read, view, store and print these with this command. All mortality events in the collar will be shown in a window. Using the *File* menu, you can save or print the events.

The collar will store up to 132 events. Every new event will be inserted at the top of the list. If the list is full, the oldest event will be deleted. Figure 97 shows the Mortality Events window with three events in the list. The time of the mortality events is displayed in both UTC and LMT. LMT is derived from the stored UTC time and the program's UTC correction (see 3.1.8.10 Miscellaneous Tab Sheet).

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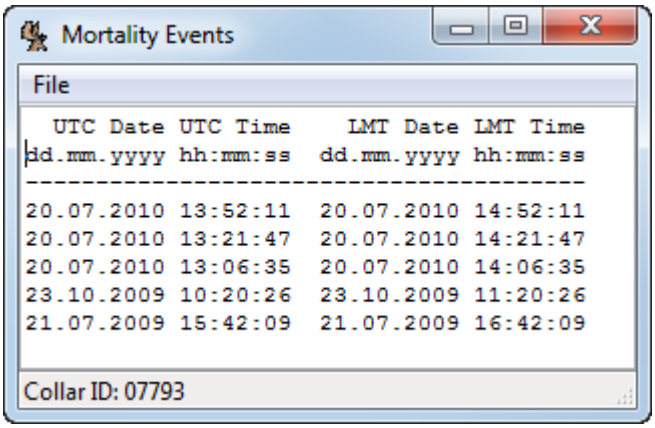

Figure 97: Mortality Events window

4.4.15 Erase Mortality Events

This command erases all mortality data is equivalent to 4.2.5 Erase Fix Data. Please refer to this description.

4.4.16 Get Proximity Data

With this command, a Save File dialog will open to allow you to save the proximity events stored in the collar as TXT file. The time of the proximity events is displayed in both UTC and LMT. LMT is derived from the stored UTC time and the program's UTC correction (see 3.1.8.10 Miscellaneous Tab Sheet). Transmitter [ID] indicates the ID number of the encountered UHF ID tag. RSSI [dBm] indicates the strength of the ID transmitter's signal.

```
UTC_Date    UTC_Time  LMT_Date    LMT_Time  Transmitter RSSI
dd.mm.yyyy  hh:mm:ss  dd.mm.yyyy  hh:mm:ss  [ID]        [dBm]
=============================================================
17.03.2010  18:02:36  17.03.2010  19:02:36  12489        -78
17.03.2010  18:02:36  17.03.2010  19:02:36  05555        -76
18.03.2010  11:02:36  18.03.2010  13:02:36  55555        -80
18.03.2010  11:02:36  18.03.2010  13:02:36  00256        -67
```

Figure 98: Sample proximity data file

4.4.17 Erase Proximity Data

This command erases all proximity data and is equivalent to 4.2.5 Erase Fix Data. Please refer to this description.

4.4.18 Clear Argos Buffer

Clear Argos Buffer clears the internal Argos transmission buffer of the connected collar.

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4.4.19 Warmstart GPS

This command should only be used for diagnostics and outside of buildings with free access to the sky! A GPS warm start is performed immediately.

The command will open a *GPS Data* window (see Figure 99 without data), and the program will try to contact the collar. If no connection was established, the message a window will state Connection could not be established! and the OK button will be enabled so that the message window can be closed. This will close all but the main window.

After connection has been established, the warmstart will be initiated and the message window will be closed. The program then waits for data, which can take a while for the first data set. You can close the window anytime, but the collar will not stop sending GPS data until it has received several successive fixes or the GPS On time is reached. If the window remains open, data will be updated until one of the above-mentioned criteria is reached. The window will not close automatically. The resulting fixes are stored in the position memory of the collar.

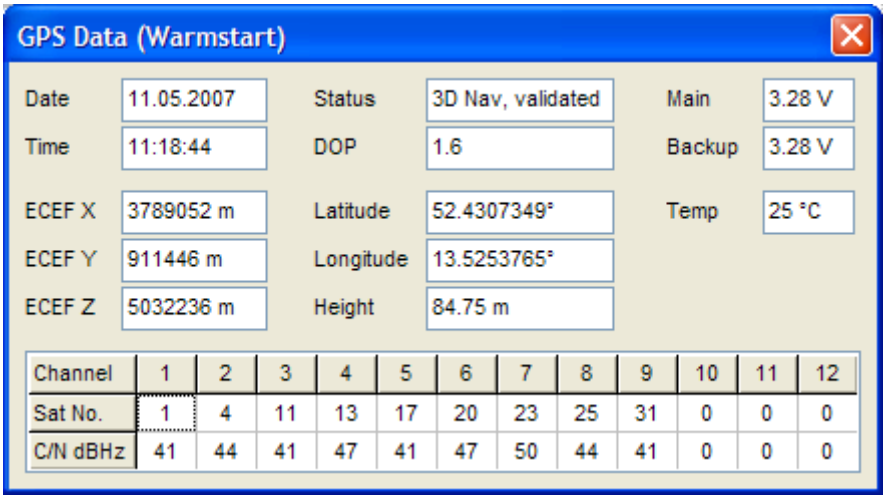
GPS Data (Warmstart)
Date 11.05.2007
Time 11:18:44
ECEF X 3789052 m
ECEF Y 911446 m
ECEF Z 5032236 m
Status 3D Nav, validated
DOP 1.6
Latitude 52.4307349°
Longitude 13.5253765°
Height 84.75 m
Main 3.28 V
Backup 3.28 V
Temp 25 °C
Channel 1 2 3 4 5 6 7 8 9 10 11 12
Sat No. 1 4 11 13 17 20 23 25 31 0 0 0
C/N dBHz 41 44 41 47 41 47 50 44 41 0 0 0

Figure 99: GPS Data main window

Date and Time: date and time of the GPS receiver in UTC (Universal Time Coordinated)

ECEF X,Y and Z: the measured position in x, y and z coordinates of the Earth Centred Earth Fixed coordinate system.

Status: the quality of the displayed position

DOP: Dilution of Precision (in 2D mode it is only horizontal DOP [HDOP])

Latitude, Longitude and Height: the measured position in WGS84 coordinates

Main and Beacon: voltage of the corresponding battery

Temp: temperature of the collar

At the bottom is a table containing satellites and their signal to noise ratio in dBHz.

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4.4.20 Coldstart GPS

This command should only be used for diagnostics and outside of buildings with free access to the sky! A GPS cold start is performed immediately. This means that the RTC (Real Time Clock), the ephemerides and position are cleared. The result is stored in the position memory of the collar.

The command is quite similar to the warmstart GPS command, but will need much longer for the first data set and even longer to get a position fix because the ephemerides data have to be acquired from the satellites again. The *GPS Data* window will be similar to Figure 99.

4.4.21 Monitor GPS

This command should only be used for diagnostics and outside of buildings with free access to the sky! The *GPS Data* window (Figure 99) will be displayed immediately, but no command will be sent. The program will only listen for GPS data from the collar. This command can be used if the *Coldstart* or *Warmstart* window has been accidentally closed.

4.4.22 Restore Configuration

This feature is not available for all collars. For collars that have been manufactured or refurbished at VECTRONIC Aerospace in the last years, a file containing the original configuration of the collar (no schedules) can be provided by VECTRONIC Aerospace on request only. Select the appropriate .CCF file from the Open File dialog and press Open. The file will be sent to the collar and the original configuration will be restored. Since all configurations can be changed with the Collar Configuration commands, you usually will not need this command.

4.4.23 Collar Firmware Update

Under certain circumstances it might be necessary to update the firmware of your collar. You should not do this unless you experience problems with the current collar firmware or need a feature only available in a newer version than yours. In this case, get the appropriate file from VECTRONIC Aerospace. Then select the *Firmware Upload* command. Select the update file with and start the upload. The upload will be verified automatically while it is progressing.

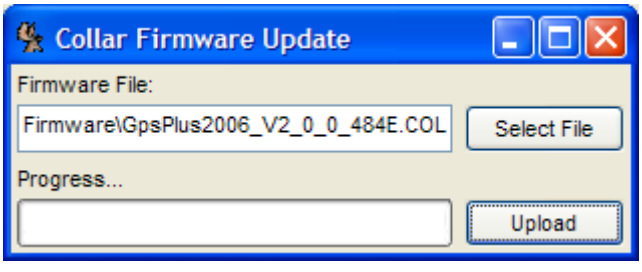

Figure 100: Firmware Update window

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4.4.24 Link Manager Telemetry

This command displays information about your link manager.

Version: Software Version

Date: Release date of the software

Flags: Internal flags needed for customer support on the link manager

Voltage of the rechargeable battery. This is only relevant for the Link Manager 1. This system will not work at voltages below 2.5. At Voltages below 3 the link manager should be charged. The link lamp on the device will then blink red instead of green (see link manager manual).
The Link Manager 2 (USB interface only), does not have an internal battery, so it will always return 3.30 V.

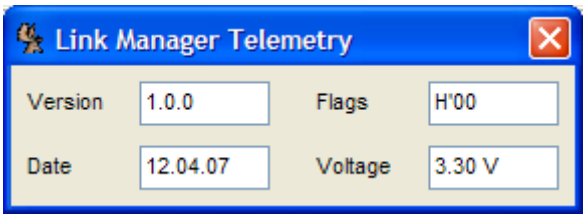

Figure 101: Link manager telemetry window

4.4.25 Link Manager Firmware Update

This command only works for Link Manager 2 (USB Stick style with two cables)!

GPS Plus has included a firmware for Link Manager 2. Normally, GPS Plus detects if the Link Manager 2 has a firmware older than the running GPS Plus version at start-up and updates it automatically if necessary. This command allows you to trigger this update manually. If the Link Manager's version is newer than your update file, GPS Plus will ask if you really want to downgrade.

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4.5 Com Port Menu

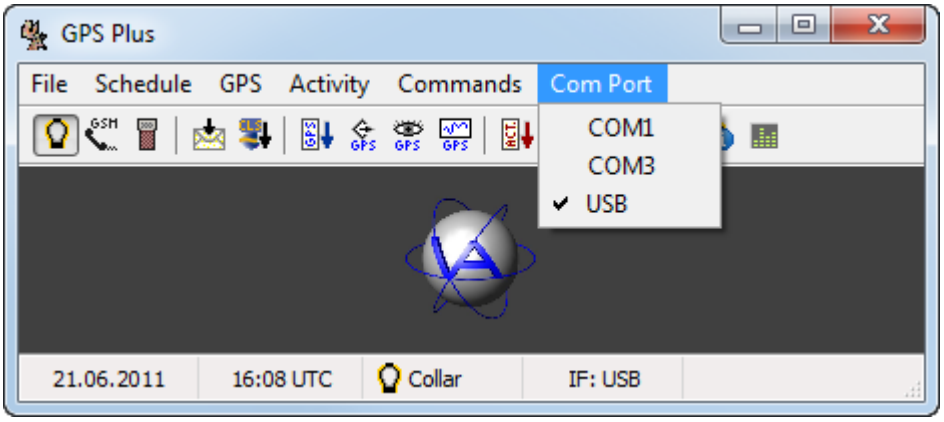

Figure 102: Main window with Com Port menu open (in Collar mode)

With this menu, you can select the COM port to which you want to connect your collar via the Link Manager. This has no effect on the interface used for the GSM Base Station and the Handheld Terminal. The data rate cannot be set because it is fixed to 115200 bit/s. If you do not know which port you are connected to, just start with port one and select *Collar Telemetry* from the *Commands* menu. If you do not get garbage data or an error message, then you probably have found your port. Otherwise try the next port until you found your port.

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5 GSM Base Station Mode

This mode allows you to read messages from GSM collars received by a GSM modem. The messages can be merged to GPS data files and exported or displayed as graph. When you change to this mode from another one, a new window will open either right or left of the main window. This window shows the number of read SMS messages and their corresponding Collar IDs. Normally, there will be no entries when changing to this mode.

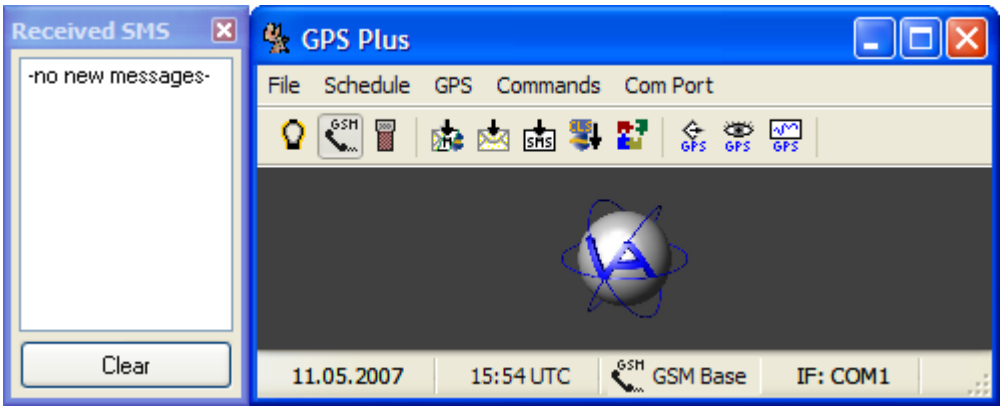

Figure 103: Main window in GSM Base Station Mode with Received SMS window (left)

5.1 Schedule Menu

The *Schedule* menu in the GPS Base Station mode is similar to the *Schedule* menu in the Collar mode (see chapter 4.1). Since no direct communication with the collar is possible (the GSM module of the collar is normally switched off and is only activated for transmission), all receive routines are unavailable.

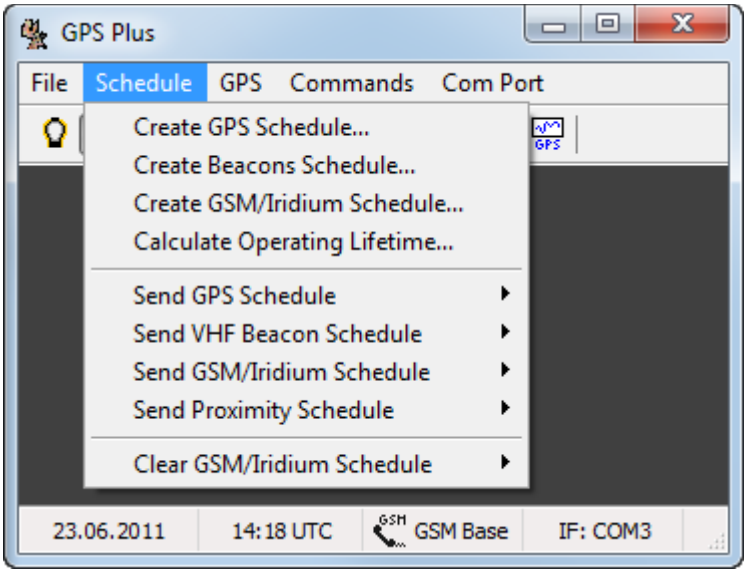

Figure 104: Main window with Schedule menu open (GPS Base Station mode)

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5.1.1 Create GPS Schedule

This is equivalent to 4.1.1 Create GPS Schedule. Please refer to this description.

5.1.2 Create Beacon Schedule

This is equivalent to 4.1.2 Create Beacon Schedule. Please refer to this description.

5.1.3 Create GSM/Iridium Schedule

This is equivalent to 4.1.4 Create GSM/Iridium Schedule. Please refer to this description.

5.1.4 Lifetime Calculation

This is equivalent to 4.1.5 Lifetime Calculation. Please refer to this description.

5.1.5 Send GPS Schedule

This command offers you two ways for sending a schedule, via GSM and via Iridium. Choose the communication form enabled in your collar.

5.1.5.1 Send via GSM

This command is quite similar to 4.1.6 Send GPS Schedule. For items not explained here, please refer to this section.

Figure 105: Selection of transmission media

Since an SMS message has a very low data capacity, you can only send rule based schedules with a restricted number of rules: A maximum of 16 rules is possible, but depending on the type and length of the rules a fewer number might possible.

First select the GPS rule file (.GRF) by clicking on Select File and choosing a file from the *Open File* dialog. If this schedule is too large to be sent via GSM, you will receive an error message and the file will not be accepted.

After you have selected an appropriate schedule file, you need to select the destination collar. To select multiple collars, hold down CTRL and click on list entries to select or deselect collars or hold down SHIFT to select a range of entries. The list is generated from registered collars only. It is not possible to send schedules to not registered collars. It sends the selected schedule via SMS to the collar. Store as SMS will store the selected schedule as an SMS file to be transmitted with the GSM reception form for each selected collar.

The schedule will be received by the collar when it activates its GSM module. The received schedule is checked for transmission errors and then loaded into the collar and activated. You

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will not receive an acknowledgement, so check if the fixes in the next data transmissions have been obtained according to the new schedule; if not, resend the schedule.

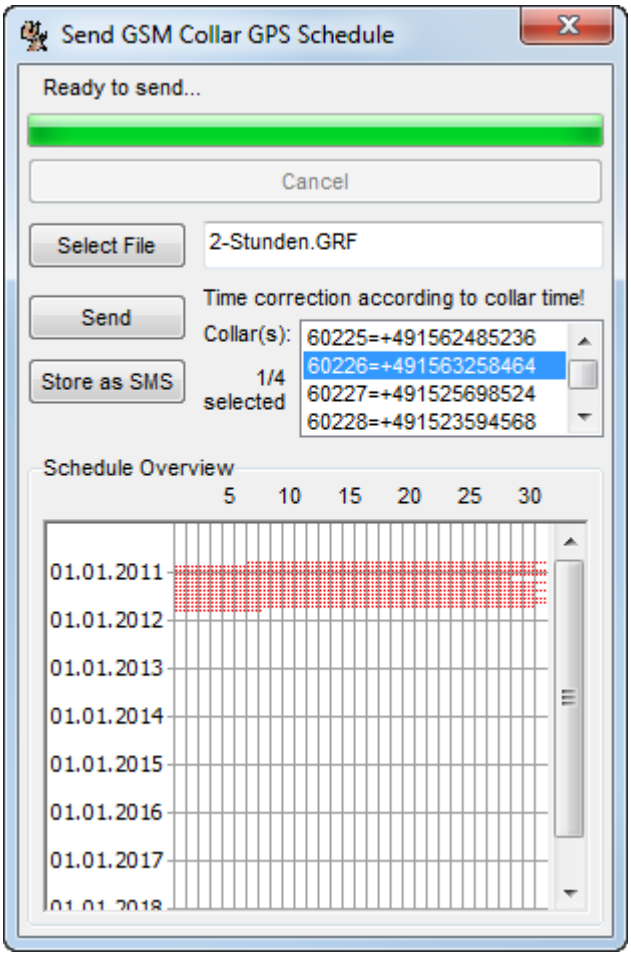

Figure 106: Send GPS Schedule window when using a GSM modem

5.1.5.2 Send via Iridium

This command is similar to sending via GSM (see 5.1.5.1 Send via GSM). The only difference is that you select the collars by their ID and valid IMEI address instead of their phone numbers. Messages transmitted via Iridium are sent as emails to the iridium service centre, which forwards the data in the email to the appropriate transceiver.

5.1.6 Send VHF Beacon Schedule

This command is very similar to 5.1.5 Send GPS Schedule. Please refer to this description. The only difference is that you select a beacon schedule file (.BRF) instead of a GPS schedule (.GRF).

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5.1.7 Send GSM/Iridium Schedule

5.1.7.1 Send via GSM

This command opens a form to select the receiving collars and the GSM schedule file (Figure 107). Select a collar from the Destination Collars list by checking the box at the left or double-clicking on the collar. You can also use All, None, and Toggle to select collars. Press Select to select a Schedule file (.GSF). The status line underneath the file name should now state Valid schedule, and will give you the number of rules in the schedule and the binary size of the schedule (max 109 bytes). After you have selected at least one collar and a valid schedule, Send will be enabled. It sends the selected schedule via SMS to the collar.

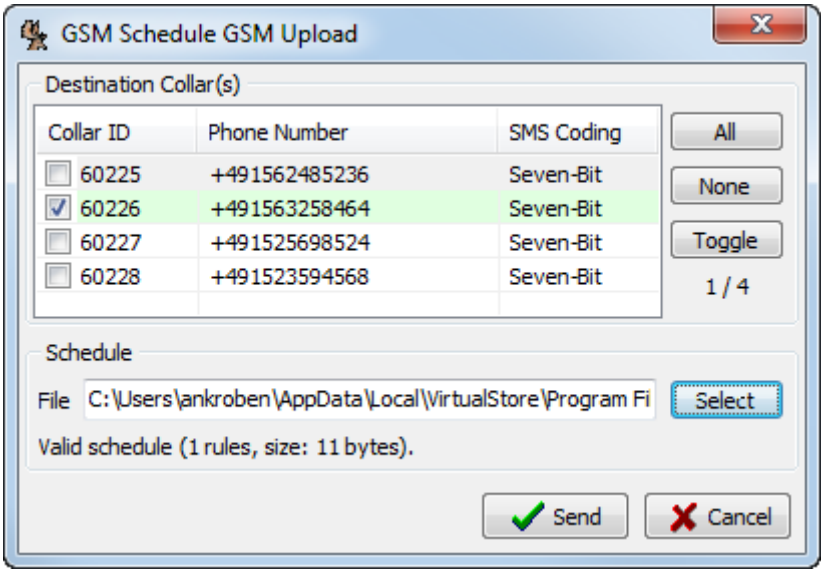

Figure 107: Send GSM Schedule window when using a GSM modem

The schedule will be received by the collar when it activates its GSM module. The received schedule is checked for transmission errors and then loaded into the collar and activated. You will not receive an acknowledgement, so check if the next SMS have been sent according to the new schedule; if not, resend the schedule.

5.1.7.2 Send via Iridium

This command is similar to sending via GSM (see 5.1.7.1 Send via GSM). The only difference is that you select the collars by their ID and valid IMEI address instead of their phone numbers. Messages transmitted via Iridium are sent as emails to the iridium service centre, which forwards the data in the email to the appropriate transceiver.

5.1.8 Send Proximity Schedule

This command is equivalent to 5.1.5 Send GPS Schedule.

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5.1.9 Clear GSM/Iridium Schedule

This command clears the GSM/Iridium schedule. This is the only way of disabling the GSM/Iridium schedule. Select the receiving collars from a list similar to 5.1.7.1 Send GSM Schedule via GSM and 5.1.7.2 Send Iridium Schedule via Iridium. After successfully clearing the schedule, a success message is shown.

5.2 GPS Menu

The *GPS* menu includes commands needed to process the measured position data received with the GSM modem. It is partly similar to the GPS menu in the Collar mode (see 4.2 GPS Menu).

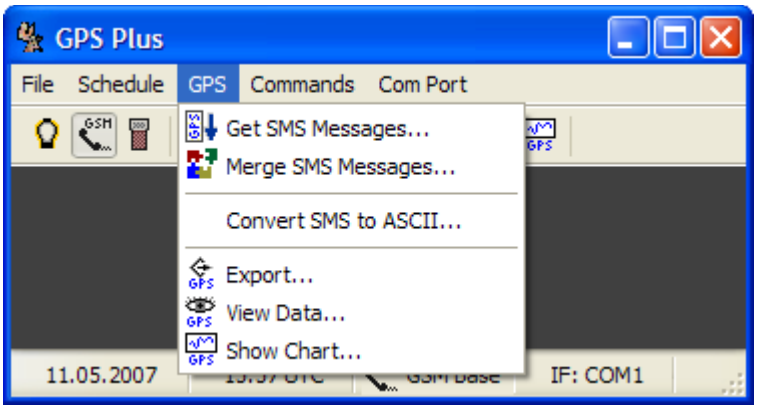

Figure 108: Main window with GPS menu (GPS Base Station mode)

5.2.1 Get SMS Messages

This command can also be accessed via the toolbar symbol shown to the left. It allows you to interactively read SMS messages from the GSM modem received from GSM collars.

The command will open a window for data reception (Figure 109). Press Read SMS to start the data reception. Stop will change to Stop with two small arrows going round in a circle to indicate the activity (Figure 110). You can always stop reading by clicking on Stop. It will then change to Stopping... and the program will finish the processing of the current SMS memory.

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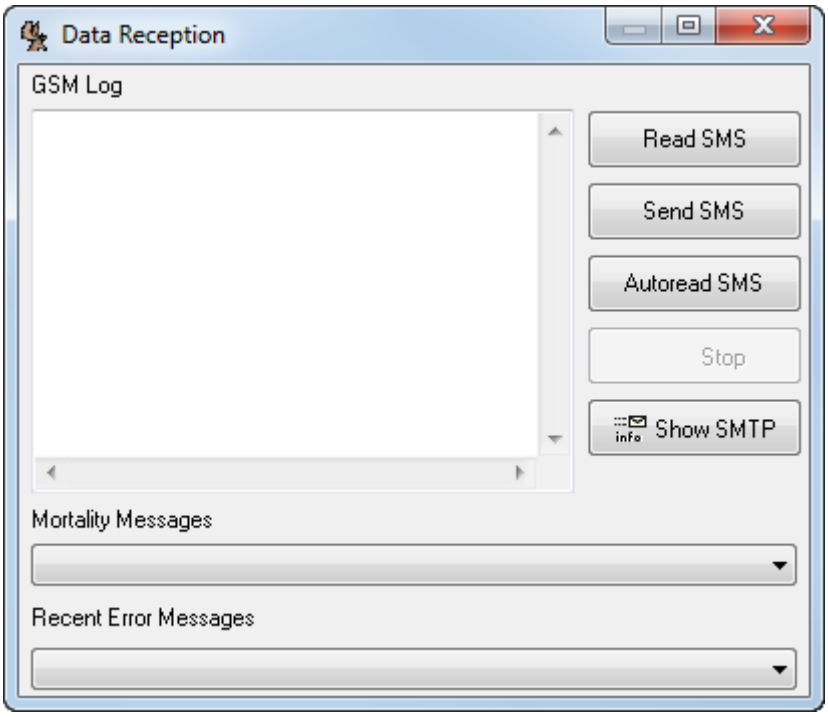

Figure 109: Get SMS Messages window after initialisation

When starting the reception, all SMS message memories are checked whether they contain newly received or already read messages (see Figure 110). Messages that are held for sending are ignored. Then, first the newly received messages and the already read messages are read. After a message is read it is checked and, if it is valid, stored, given that it matches any of the SMS formats used to send data.

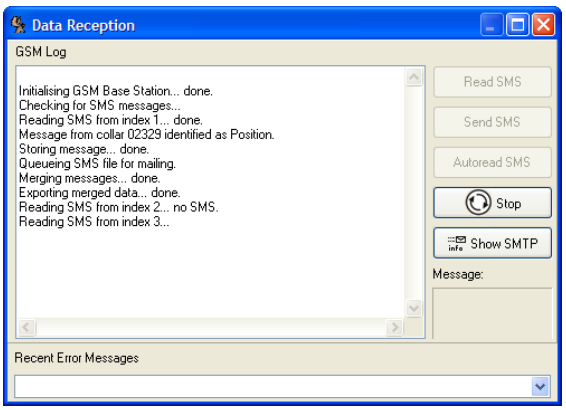

Figure 110: Data Reception form while starting Read SMS (currently reading first message)

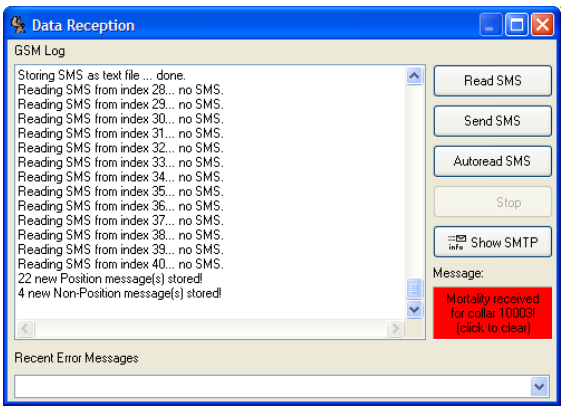
Data Reception
GSM Log
Storing SMS as text file ... done.
Reading SMS from index 28... no SMS.
Reading SMS from index 29... no SMS.
Reading SMS from index 30... no SMS.
Reading SMS from index 31... no SMS.
Reading SMS from index 32... no SMS.
Reading SMS from index 33... no SMS.
Reading SMS from index 34... no SMS.
Reading SMS from index 35... no SMS.
Reading SMS from index 36... no SMS.
Reading SMS from index 37... no SMS.
Reading SMS from index 38... no SMS.
Reading SMS from index 39... no SMS.
Reading SMS from index 40... no SMS.
22 new Position message(s) stored!
4 new Non-Position message(s) stored!
Read SMS
Send SMS
Autoread SMS
Stop
Show SMTP
Message:
Mortality received for collar 10003! (click to clear)
Recent Error Messages

Figure 111: Data Reception form after Read SMS is finished

If a message is received from a collar which phone number is not yet registered, the message will be stored as unregistered message in a ZIP file in the folder `GPS Plus\SMS\NotRegisteredCollars_GSM.ZIP`. You can process these messages with File/Process unregistered collar messages (see 3.1.4).

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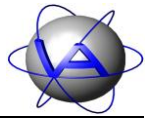

The processing of position messages includes:

- The message is stored in an SMS-file in the SMS subdirectory of the base data path.
- If it is a position message, it will be exported as a text file without a header in the SMS text directory (see 3.1.8.7 Export I Tab Sheet). The format is defined by the standard ASCII export options (3.1.8.8 Export II Tab Sheet).
- If selected in the options, the stored position message is automatically merged with all other messages from the same collar into a .GDF-file.
- If selected in the options, the merged .GDF-file will be exported to the selected format (ASCII, spreadsheet, or database; see 3.1.8.1 SMS Handling Tab Sheet).
- If selected in the options (3.1.8.1 SMS Handling Tab Sheet), the message file will be queued for emailing to the configured position data recipients (3.1.6 Collar List).

The processing of mortality messages includes:

- The mortality event is added to a text file (`GSM_MortalityEventsxxxxxYYMMDDHHMMSS.txt` in the mortality directory of the base data path).
- The message will be stored as an SMS text file (Mortality_[phonenumber]_ [datetime].TSM) in the Inbox folder.
- If selected in the options (see 3.1.8.1 SMS Handling Tab Sheet), this file will be queued for emailing to the configured mortality data recipients (see 3.1.6 Collar List).
- If any recipients are in the mortality SMS list (3.1.6 Collar List), the message will furthermore be forwarded as a SMS message to the given phone number(s).
- The message panel will start to blink red and notify you of the reception of a mortality SMS from the collar with the given ID. Every ten seconds the program will make a “beep” sound (unless sound is disabled in the Options-Misc section). Clicking on the panel will clear it and open a window listing all mortality events received since last program start with Collar ID and their time of occurrence.

The processing of all other messages includes:

- If selected in the options (3.1.8.1 SMS Handling Tab Sheet), the message will be stored as a Text-SMS-file (.TSM) and/or PDU-SMS-file (.PSM) in the Inbox subdirectory of the SMS directory.

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Emailing is done by the SMTP Send Bot (see section SMTP Send Bot), which can be made visible by clicking on Show SMTP. After processing is completed, the message is deleted from the GSM modem memory and the Received SMS List window is updated. It may then look like Figure 112 and is only for your information, when merging the messages.

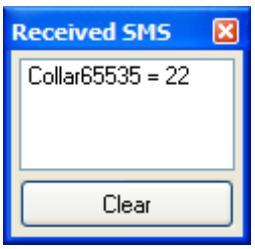

Figure 112: Received SMS window with two collar entries

The window can now be closed or Read SMS can be pressed again. If you had messages stored in all memories, we recommend to wait a moment and repeat Read SMS because it can take a while (sometimes several minutes) until the service centre of the service provider sends more messages, which the GSM module has not receive yet.

Pressing Send SMS will disable the all buttons, but enable Stop. The Outbox subdirectory of the SMS directory will be checked for unsent messages in PDU (.PSM) and Text (.TSM) format. If sending a message was successful, it will be renamed to *.~PS / *.~TS or (depending of the options, see 3.1.8.1 SMS Handling Tab Sheet) deleted. If sending was unsuccessful, the message will be renamed to .!PS / .!TS.

Pressing Autoread SMS starts an automated read function. The button will be disabled and Stop will change to Stop with two small arrows going round in circle to indicate the activity. You can always stop reading by clicking on Stop. It will then change to Stopping... and the program will finish the processing of the current SMS memory.

First the program will check for messages to send (like the Send SMS command previously described) and send them (if any). Then it will read the GSM modem's SMS memory as in the Read SMS command. It will repeat these two actions over and over again with a pause between two cycles defined in the options form (see 3.1.8.10 Miscellaneous Tab Sheet). If a new SMS has arrived, it will be handled just as by the Read SMS command. An unknown phone number will result in the same procedure as using the Read SMS command and a window will open to enter the necessary details to recognise the collar (For details refer to 3.1.4 Process unregistered collar messages).

The Received SMS window will be updated, if a new message is correctly stored. To stop Auto Read press Stop. You will not be able to close the window without previously stopping Auto Read.

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5.2.2 Merge Messages

This command can also be accessed via the toolbar symbol shown to the left. It merges received and stored messages from one collar to a GPS data file.

The window shown in Figure 113 consists of a Combo Box at the top, which lists all collars that have stored messages. Beneath it, there is a list window showing all message files for the collar selected. In the Received SMS window (see Figure 112) you can see a list of collars and the number of their newly received messages for your information.

Select a collar ID from the combo box of which you want to merge the messages to a data file. The IDs will not be sorted, but will appear in the order they have been registered! It is only useful to select IDs that are also listed with new messages since without new messages there will be no new data file. Now you can select the messages by clicking on them or by pressing on of the first three buttons on the right: Select All selects all messages, Clear All unselects all messages and Invert Selection unselects all which were marked and selects all unmarked. If you click on one message, all other messages will be deselected. If you hold down Shift you can mark a range of messages. By holding down Ctrl you can mark several single messages.

After you have selected the messages you want to merged, start merging with pressing Merge. A save file dialog will open up with an optional file name, which you can change. If the file name already exists you will be prompted for a confirmation. Otherwise a progress bar will open while the messages are merged. Since merging is very fast you might only notice a short blink instead of seeing the progress bar. With a "ding" sound merging is finished. The data of the selected message files are now in one data file. You can now export this file with *Export ASCII / Spreadsheet* commands or view it in a chart with the *Show Chart*.

Alternatively to merging only data of one collar at a time you can also merge all available data with one click: Merge All Messages for every Collar will merge all SMS files into separate files for each collar with automatically generated file names (GSMxxxxx.GDF) .

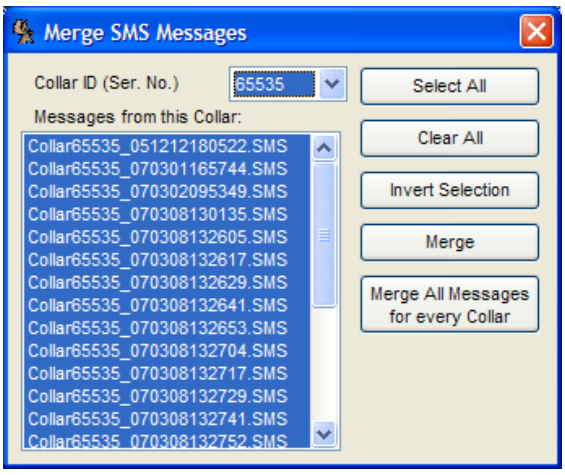

Figure 113: Merge SMS Messages window

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5.2.3 Convert SMS to ASCII

This command is very similar to 5.2.2 Merge Messages, but instead of merging the selected messages, it converts every selected message to a text file containing the ASCII export of the message without header, just like it is done automatically when a position SMS is received. The name of each text file is the same as the SMS file name but with .TXT as extension. The files will be written to the SMS text directory, which can be configured in the Export I Tab Sheet (see 3.1.8.7).

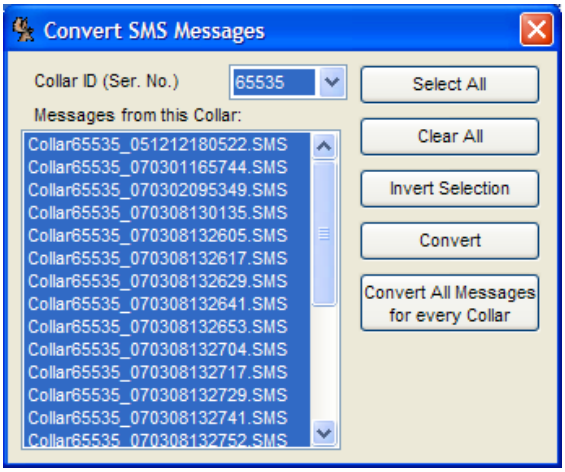

Figure 114: Convert SMS Messages window

5.2.4 Export GPS Data

This command can also be accessed via the toolbar symbols shown to the left. This is equivalent to 4.2.2 Export GPS Data. Please refer to this description. Because not all data is transmitted, some of the data sets in the exported file is marked as not available ("n/a").

5.2.5 View GPS Data

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 0 View GPS Data. Please refer to this description. Because not all data is transmitted, some of the data sets in the exported file is marked as not available ("n/a").

5.2.6 Show chart

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 4.2.4 Show GPS Chart. Please refer to this description.

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5.3 Commands Menu

This menu enables you to remotely configure the collar including the virtual fence option and the proximity sensor. It also gives you status information on the GSM modem and allows you to set a PIN-code.

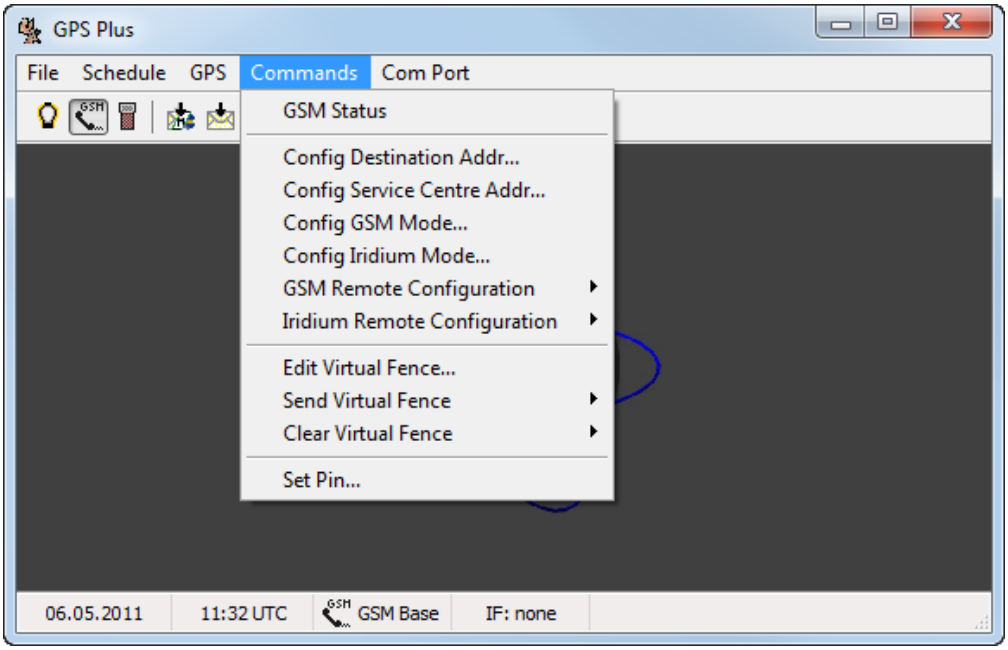

Figure 115: Main window with Commands menu open (GSM Base Station mode)

5.3.1 GSM Status

GSM Status gives a small status overview of the connected GSM modem. If needed, the command will set the PIN Code and book the GSM modem into the GSM net. This may take a while and if you have just switched on the modem, an error may occur. Just wait for at least ten seconds and try again.

Manufacturer of the modem

Model of the modem

Registration: Connection status. It can be registered, roaming or not booked in.

Provider: Name of the network provider to which the modem is registered

Signal Quality, displayed as a bar graph, which should be green. If it changes to red, it reaches a level that will under normal conditions work but may fail from time to time.

Stored Messages: number of messages currently stored in the memory and the maximum possible number of messages that can be stored

Service Centre: service centre number of the GSM service provider.

Activity Status: current activity of the modem

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PIN Status: result of the PIN identification.

Press Read Again to refresh the information.

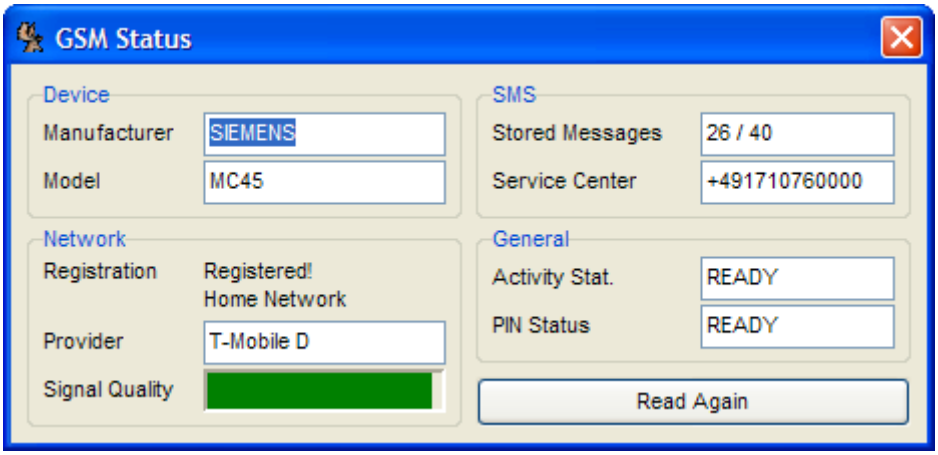

Figure 116: GSM Status window

5.3.2 Configure Destination Address

This command enables you to change the destination address of a collar (the phone number, where the SMS messages are send to) via an SMS message. Select a collar from the Destination Collar(s) list and enter the New Destination Address. Press Transmit to generate an SMS message and send it to the collar. The only verification is by receiving the next message of the collar on the new phone number.

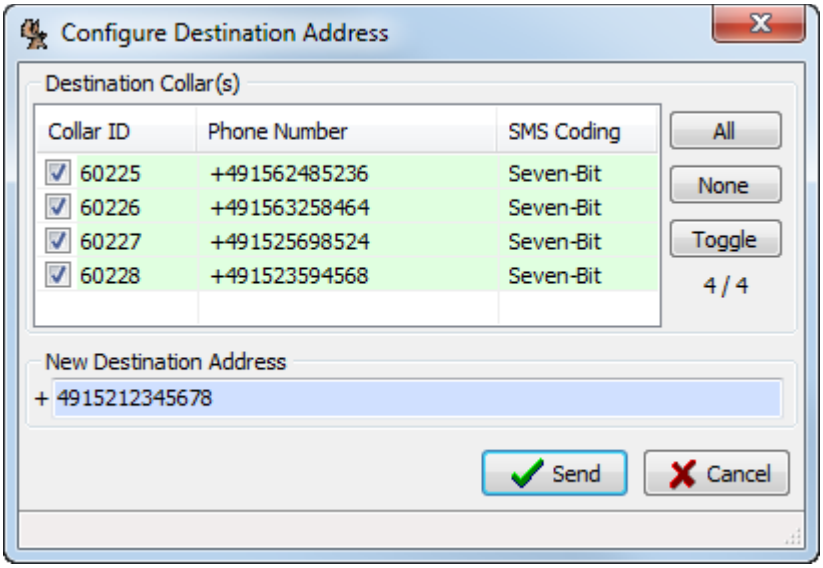

Figure 117: GSM Configure Destination Address form

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5.3.3 Configure Service Centre Address

This command enables you to change the service centre address of a collar (the service centre's phone number of your GSM provider) via a SMS message. The only purpose of this command is to restore a service centre address in a collar, if it is erased or changed by accident. This will make the collar dumb, because it has no address for SMS message handling, but it is still able to receive SMS messages. Do not ever use this command if there is no real need for it!

Select a collar from the Destination Collar(s) list and enter the New Service Centre Address Press Transmit to generate an SMS message and send it to the collar. The only verification is by receiving the next message of the collar.

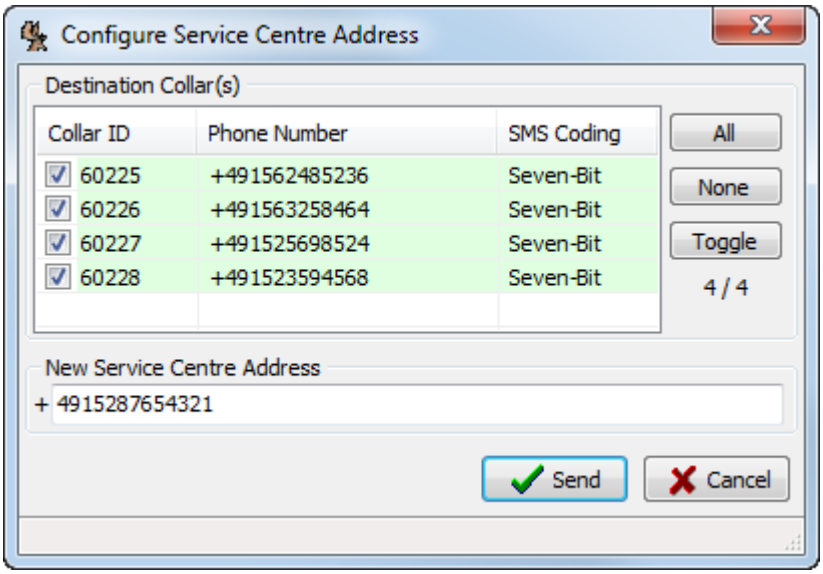

Figure 118: GSM Configure Service Centre Address form

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5.3.4 Configure GSM Mode

This command allows you to change the GSM mode of your collars via GSM. An SMS message is send to the given collar reconfiguring the GSM mode.

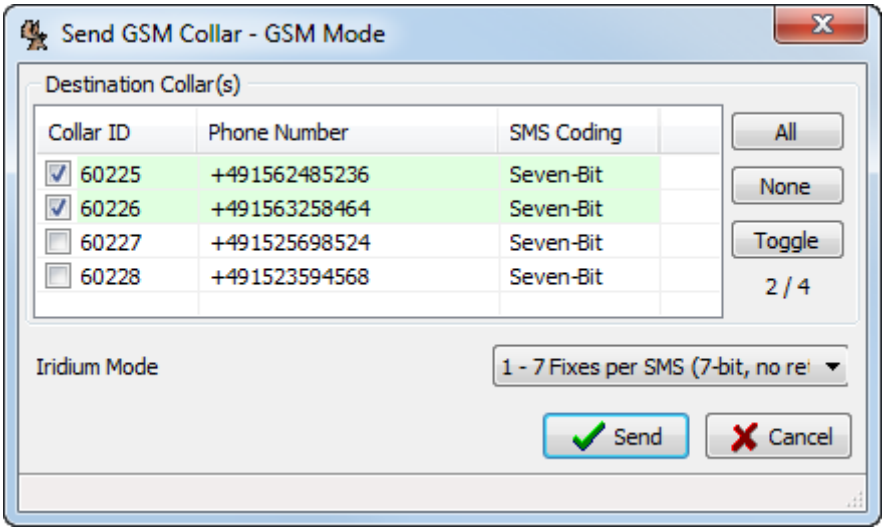

Figure 119: Configure GSM Mode via GSM

GSM mode defines how many data sets are transmitted with one SMS message and what kind of coding is used (6-bit or 7-bit). Changing the coding can make your collar incompatible with your GSM provider! The program will warn you if you are about to change the coding. Changing the number of fixes per SMS may degrade the lifetime of your collar since less data sets per SMS will lead to more SMS messages which will consume more power. However, less data sets per message will also lead to a faster update on the collar's position.

5.3.5 Configure Iridium Mode

This command allows you to change the Iridium mode of your collars via Iridium. An email is sent to the Iridium Service centre and from there forwarded to the collar.

Iridium mode defines how many data sets are transmitted with one Iridium message. Changing the number of fixes per message may degrade the lifetime of your collar since less data sets per message will lead to more messages which will consume more power. However, less data sets per message will also lead to a faster update on the collar's position.

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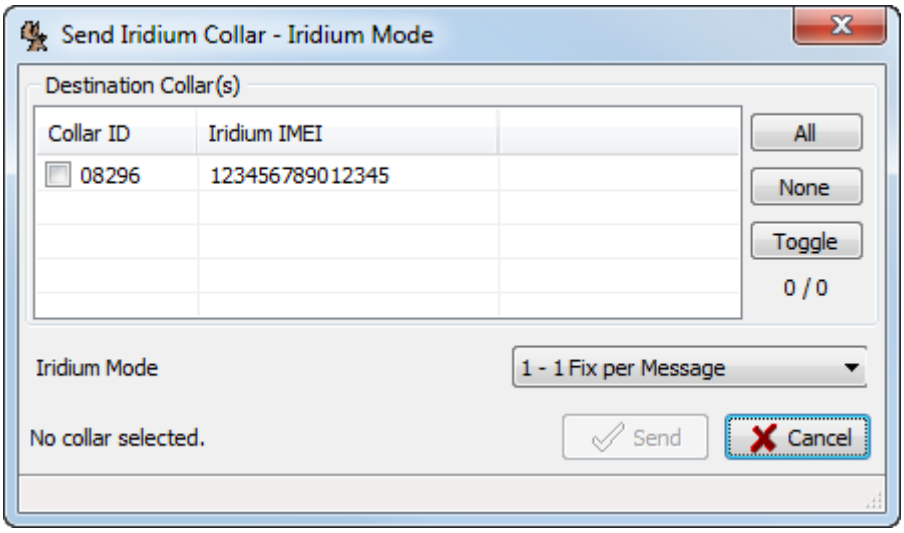

Figure 120: Configure Iridium Mode via Iridium

5.3.6 GSM Remote Configuration

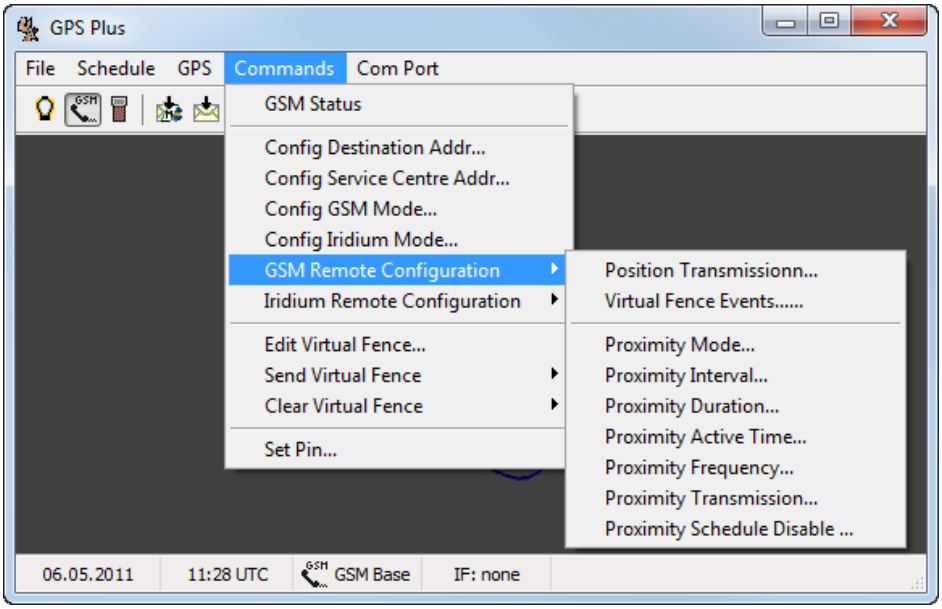

Figure 121: GSM Remote Configuration Menu

These commands allow you to change configurations of a collar regarding the GPS transmission, the virtual fence, and the proximity sensor.

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5.3.6.1 Position Transmission

This function is described in 4.4.3.16 Position Transmission. The selection of a collar is similar to 5.1.5.1 Send GSM Schedule via GSM.

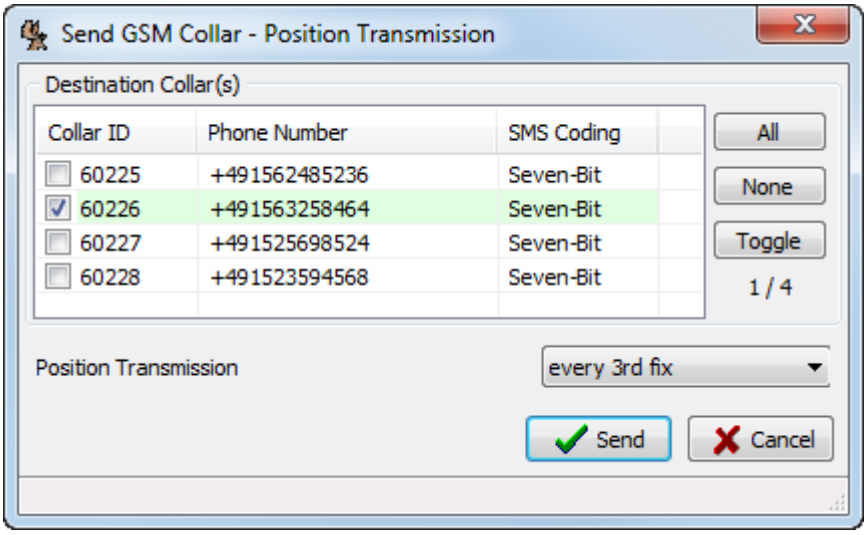

Figure 122: Dialog for sending Position Transmission command via GSM

5.3.6.2 Virtual Fence Events

You can configure the collar to send you a notification SMS when the collar has entered and/or left the virtual fence. Select a collar from the Destination Collar(s) list. Use the checkboxes underneath to indicate if you want the collar to Send Message on entering the fence area and/or Send Message on leaving the fence area. To ensure that you will receive the message, you can set a Retransmit Interval, which defines the time in minutes after which the message will be sent a second time. For details on how to select a collar and send the command, refer to 5.1.5.1 Send GSM Schedule via GSM.

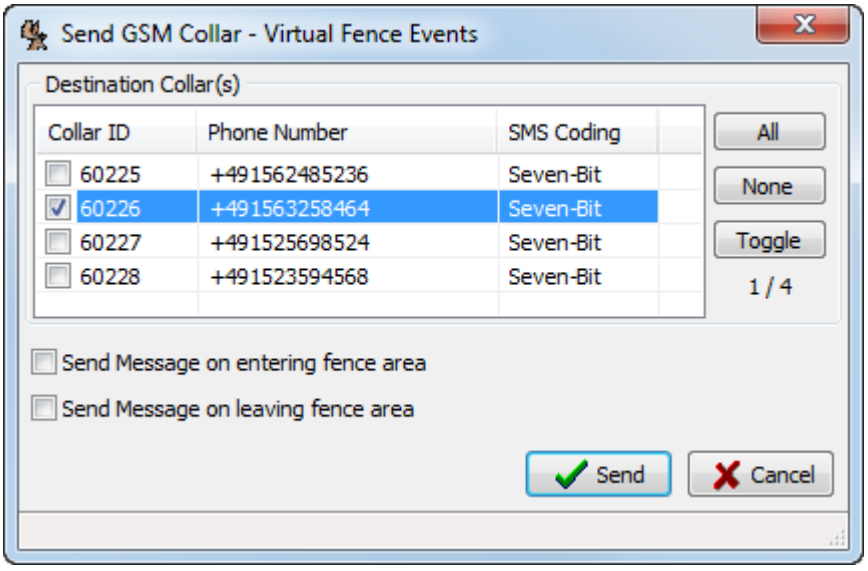

Figure 123: Dialog for sending the Virtual Fence Events command via GSM

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5.3.6.3 Proximity Mode (UHF collars only)

This command allows you to remotely enable or disable the proximity mode of a collar. Currently, only one active proximity mode is possible. For details on the proximity configuration, refer to 4.4.3.14 Proximity Sensor. For details on how to select a collar and send the command, refer to 5.1.5.1 Send GSM Schedule via GSM.

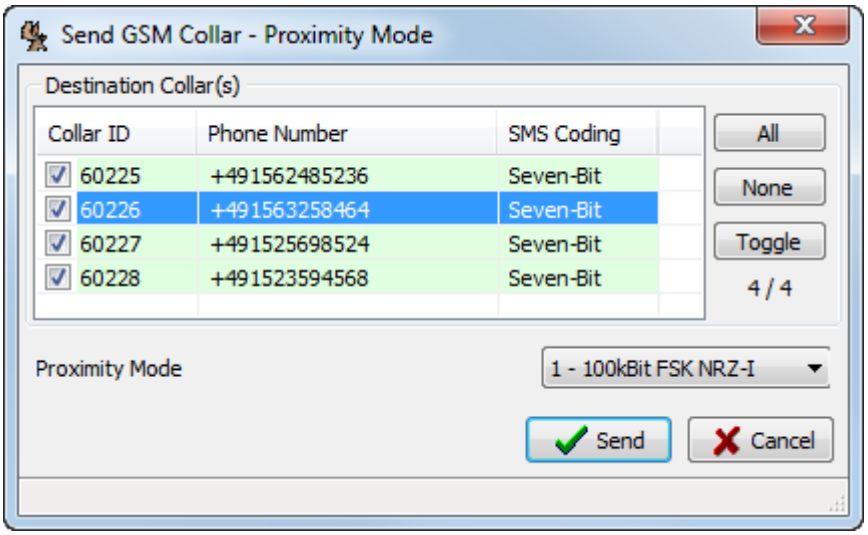

Figure 124: Dialog for configuring the Proximity Mode command via GSM

5.3.6.4 Proximity Interval (UHF collars only)

This command allows you to change the Listen Interval of the proximity sensor. For details on the proximity configuration, refer to 4.4.3.14 Proximity Sensor. For details on how to select a collar and send the command, refer to 5.1.5.1 Send GSM Schedule via GSM.

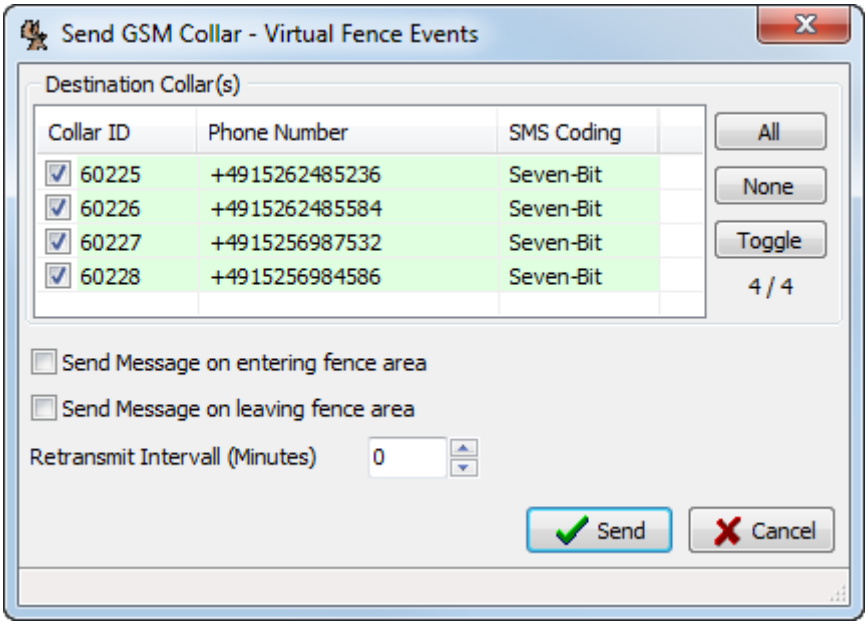

Figure 125: Dialog for configuring the Proximity Interval command via GSM

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5.3.6.5 Proximity Duration (UHF collars only)

This command allows you to change the Listen Duration of the proximity sensor. For details on the proximity configuration, refer to 4.4.3.14 Proximity Sensor. For details on how to select a collar and send the command, refer to 5.1.5.1 Send GSM Schedule via GSM.

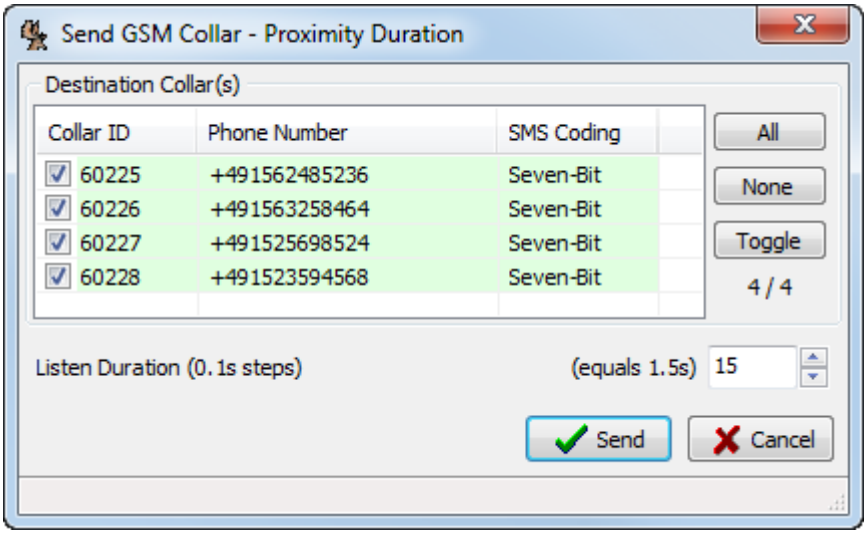

Figure 126: Dialog for configuring the Proximity Duration command via GSM

5.3.6.6 Proximity Active Time (UHF collars only)

This command allows you to change the time of day during which the of the proximity sensor is active. For details on the proximity configuration, refer to 4.4.3.14 Proximity Sensor. For details on how to select a collar and send the command, refer to 5.1.5.1 Send GSM Schedule via GSM.

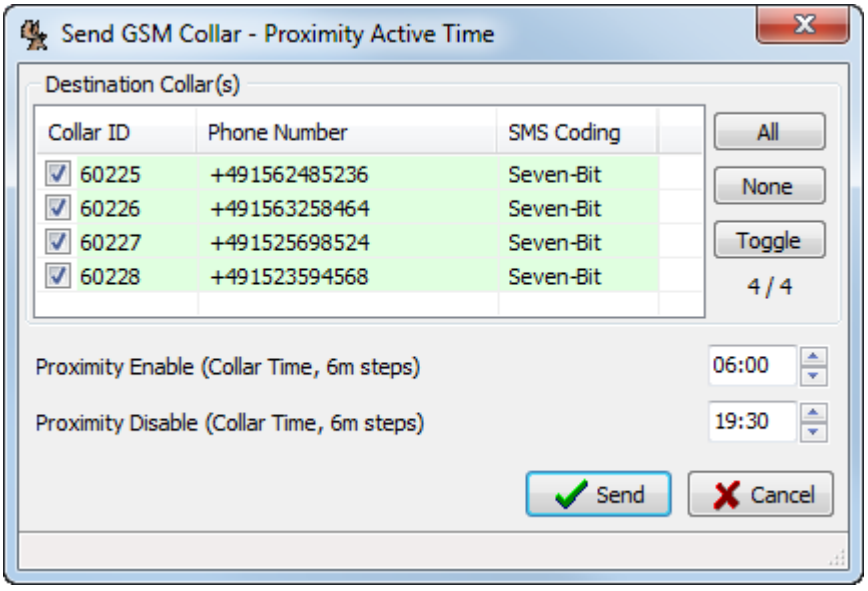

Figure 127: Dialog for configuring the Proximity Duration command via GSM

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5.3.6.7 Proximity Frequency (UHF collars only)

This command allows you to change the Receiver Frequency of the proximity sensor. Note: This frequency is defined by VECTRONIC to match your proximity sensor and the UHF ID tags. Do not change this frequency without consulting VECTRONIC. For details on the proximity configuration, refer to 4.4.3.14 Proximity Sensor. For details on how to select a collar and send the command, refer to 5.1.5.1 Send GSM Schedule via GSM.

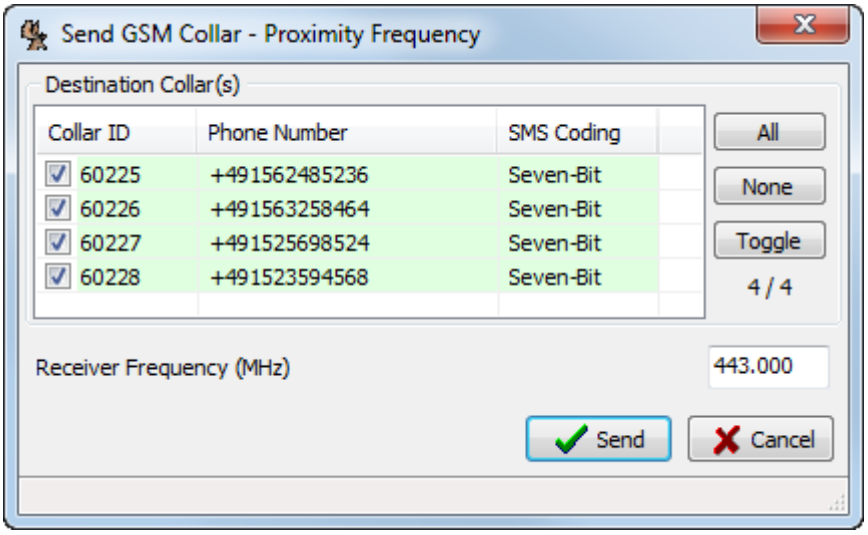

Figure 128: Dialog for configuring the Proximity Frequency command via GSM

5.3.6.8 Proximity Transmission (UHF collars only)

This command allows you to enable the transmission of proximity events (without time stamp and signal strength) via GSM or Iridium. Select the checkbox to enable the transmission or unselect it to disable the transmission. For details on the proximity events refer to 4.4.16, Get Proximity Events. For details on how to select a collar and send the command, refer to 5.1.5.1 Send GSM Schedule via GSM.

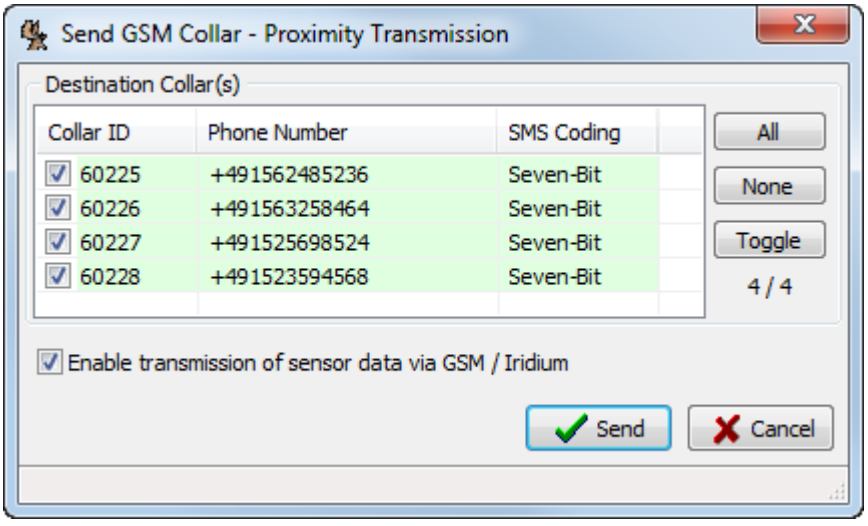

Figure 129: Dialog for configuring the Proximity Frequency command via GSM

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5.3.6.9 Proximity Schedule Disable (UHF collars only)

This command allows you to disable a GPS proximity schedule stored on a collar. To enable the proximity schedule again, you need to send a new proximity schedule to the collars (see 5.1.8 Send Proximity Schedule). For details on how to select a collar and send the command, refer to 5.1.5.1 Send GSM Schedule via GSM.

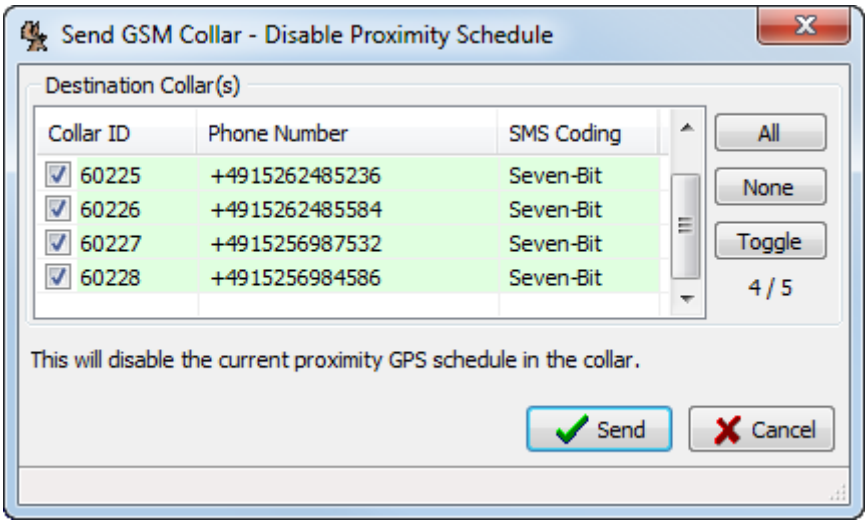

Figure 130: Dialog for configuring the Proximity Frequency command via GSM

5.3.7 Iridium Remote Configuration

These commands are equivalent to the commands in 5.3.6 GSM Remote configuration, but apply for Iridium collars. In the Destination Collar(s) list, collars are selected by IMEI, not by phone number.

5.3.8 Edit Virtual Fence

This command is the same as 4.4.9 Edit Virtual Fence. See this chapter for instructions on how to edit virtual fences.

5.3.9 Send Virtual Fence

5.3.9.1 Send via GSM

With this command, you can send a Virtual Fence Collection and an associated GPS schedule to multiple GSM collars. Just select those collars in the *Destination Collars List* which you want to receive the fence, select a Virtual Fence Collection (.VFC) and a GPS schedule, and click Send . The program will send the virtual fence to all selected collars successively.

Invalid fences or schedules prevent the transmission and are marked as such. Additionally, the size of the virtual fence and the GPS schedule must be considerable smaller than when using

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wired transmission (see 4.4.10 Send Virtual Fence). The virtual fence collection and the GPS schedule in total must not exceed a maximum length of 129 bytes.

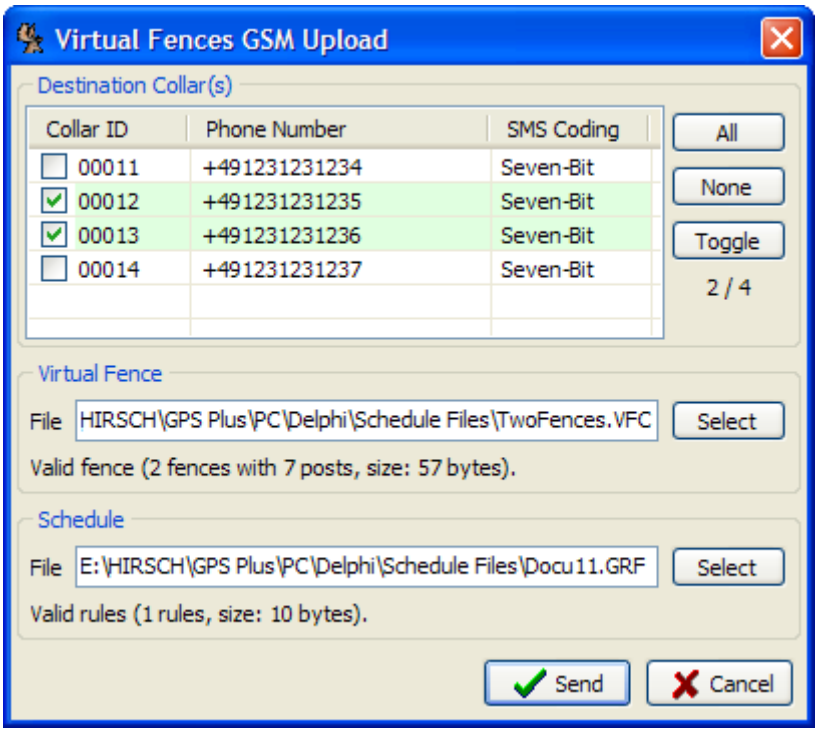

Figure 131: Dialog for sending a Virtual Fence Collection via GSM

5.3.9.2 Send via Iridium

This command is similar to the GSM version (see 5.3.9.1 Send via GSM) but is used to send the virtual fence to an Iridium collar.

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5.3.10 Clear Virtual Fence via GSM

With this command you can clear a virtual fence and an associated GPS schedule in multiple GSM collars. Just select the collars in the *Destination Collars List* you want to send the fence to and click Send. The program will send a Clear command to all the selected collars, one after the other.

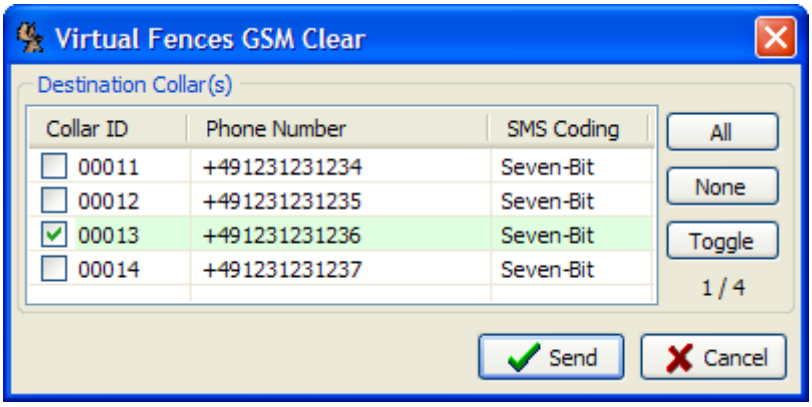

Figure 132: Dialog for clearing virtual fences via GSM

5.3.11 Clear Virtual Fence via Iridium

This command is similar to the GSM version (see 0 Clear Virtual Fence via GSM) except that you can clear the virtual fence of an Iridium collar.

5.3.12 Set Pin

This command allows setting the PIN-Code of the SIM Card in a GSM collar. Entering the PIN will only show an asterisk for each character entered. The Pin will be send to the GSM modem immediately after clicking on OK. It will also be stored and used in the Read Messages and the GSM Status command. The modem Command used is: AT+CPIN=<SIM_PIN_STRING>. If the no Pin is needed for your SIM-card, it will not be set, regardless of what you enter.

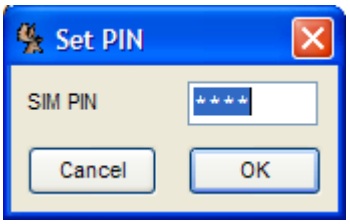

Figure 133: Set Pin window

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5.4 Com Port Menu

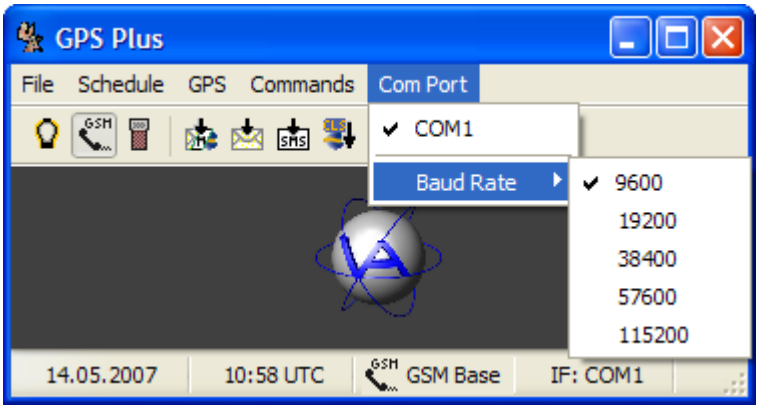

Figure 134: Main window with Com Port menu open (GPS Base Station mode)

This is very similar to 4.5 Com Port Menu. Please refer to this description. There are only two differences: USB is never available, and the data rate can be selected like the Com Port via the sub menu Baud Rate from 9600 to 115200 bit/s. Select the one that is appropriate to the GSM module you are using. Most of them work with 9600 or 19200 Baud as default and many even use autobauding, which leaves the choice to you.

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6 Handheld Terminal Mode (Firmware earlier than 2.x)

Note: There have been a lot of changes in the Handheld Terminal firmware in version 2.x and later compared to earlier versions. Therefore some commands differ in GPS Plus. If your Handheld Terminal has a firmware of at 2.x or higher, refer to 7 Handheld Terminal Mode (FW 2.x or higher).

In this mode, the program can be used to read data from a Handheld Terminal and configure it. The data can be exported or displayed as a graph.

6.1 Schedule Menu

The Schedule Menu includes commands concerning GPS measurement and beacon activation scheduling. The Commands allow the creation of GPS and beacon schedules, the sending of schedules to the Handheld Terminal and the reception of schedules from the Handheld Terminal. From the Handheld Terminal, the schedules can then be sent to a collar in the field.

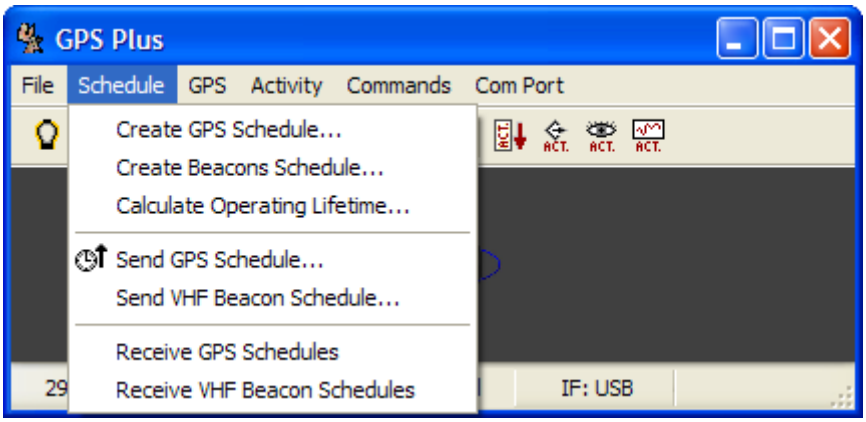

Figure 135: Main window with schedule menu open (Terminal mode)

6.1.1 Create GPS Schedule

This command is identical to 4.1.1 Create GPS Schedule. Refer to this chapter for reference.

6.1.2 Create Beacon Schedule

This command is identical to 4.1.2 Create Beacon Schedule. Refer to this chapter for reference.

6.1.3 Create GSM/Iridium Schedule

This command is identical to 4.1.4 Create GSM/Iridium Schedule. Refer to this chapter for reference.

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6.1.4 Lifetime Calculation

This command is identical to 4.1.5 Lifetime Calculation. Refer to this chapter for reference.

6.1.5 Send GPS Schedule

This command is very similar to 4.2.4 Send GPS Schedule but only rule based schedules are allowed (no selection available, thus no time selection available too) and there are several receiving collars to choose from.

After you have selected a GPS rule file (.GRF) and the schedule is displayed in the overview you need to choose in which slot of the Handheld Terminal memory it shall be stored. Every slot can be configured for one collar in the terminal (see 6.4.3 Manage Data). If the slot is already configured, then the collar ID will be displayed in the slot selector (see Figure 135), otherwise it will be marked -empty-. After you have selected the appropriate slot, press the Send button and the schedule will be transferred to the terminal.

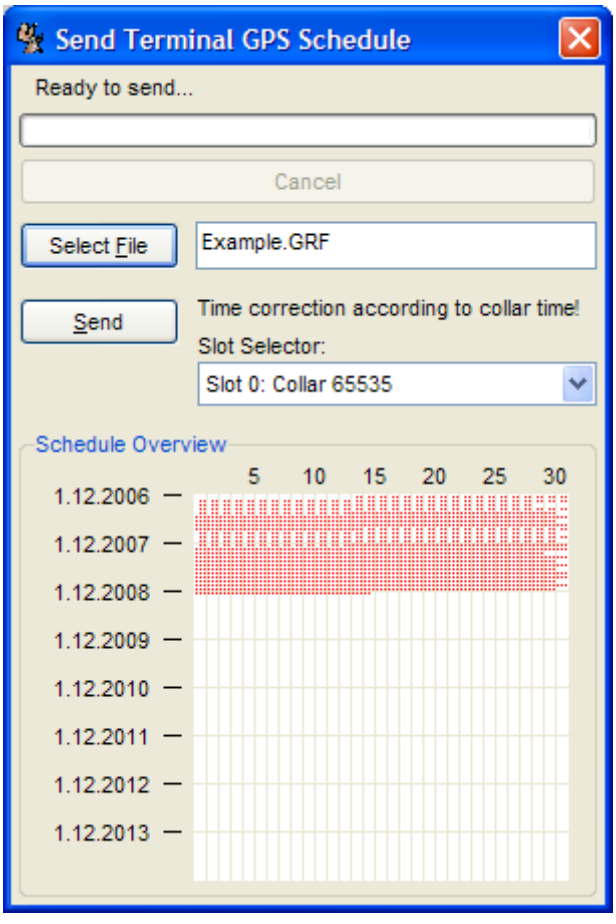

Figure 136: Send Terminal GPS Schedule main window (Firmware older than 2.X)

6.1.6 Send VHF Beacon Schedule

This command is identical to 6.1.5 Send GPS Schedule. Refer to this chapter for reference.

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6.1.7 Receive GPS Schedules

To check the GPS schedules stored on a Handheld Terminal, they can be downloaded to the PC. A Window will open while waiting for the connection with the terminal. If no connection was established, the command will be aborted. After connection has been established the main window for the download will appear (see Figure 136).

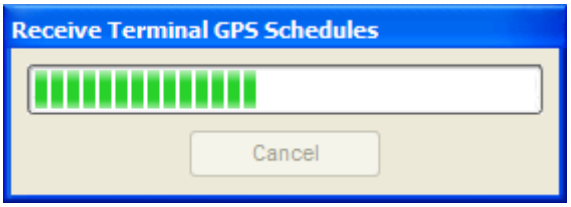

Figure 137: Receive Terminal GPS Schedules main window

Now data from all slots will be read and stored in a file in the "Schedule Files" directory as `TerminalGPSSchedules.txt`. The file contains as many entries as there are slots available in the Handheld Terminal and every entry contains a rule based schedule or, if it is empty, will be marked as empty (see Figure 137 for an exemplary excerpt).

```
Slot 0: Collar 65535
14.12.2006 - 14.12.2007 @ 09:00:00; 11:00:00; 13:00:00; 15:00:00; 17:00:00
14.04.2007 - 14.08.2007 @ 05:00:00; 07:00:00; 19:00:00; 20:00:00
14.12.2007 - 21.12.2007 & 06:30:00 - 22:00:00 # 01:00:00
22.12.2007 - 15.12.2008 & 06:00:00 - 18:00:00 § 06:15:00

Slot 1: Collar 65534
- rules not active -
      :
      :
      :
Slot 15: -no collar-
- rules not active -
```

Figure 138: Terminal GPS schedules file example

Figure 138 shows the begin of the file, starting with slot 0 containing the schedule of collar 65535. The next entry is Slot 1, containing the schedule (which is in this case not active) of collar 65534, and so on until slot 15, which has no collar associated with it and therefore no active schedule.

6.1.8 Receive VHF Beacons Schedules

This command is almost identical to 6.1.7 Receive GPS Schedules, but the file will be is stored as `TerminalVHFSchedules.txt`.

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6.2 GPS Menu

The *GPS* menu includes commands needed to process the measured position data received with the GSM modem. It is partly similar to the GPS menu in the Collar mode (see 4.2 GPS Menu).

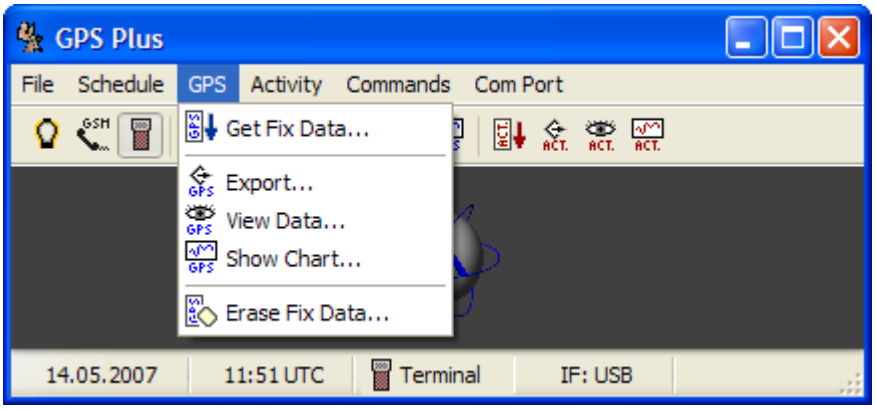

Figure 139: Main window with GPS menu open (Terminal mode)

6.2.1 Get Fix Data

This command can also be accessed via the toolbar symbol shown to the left. This command is the equivalence to 4.2.1 Get Fix Data.

As you can see, the Handheld Terminal has several memory slots that may contain position data of collars. To read the data, you need to select one or more slots from the list on the left. If no collar has been associated with a slot, it will be labelled as empty. Selection of multiple slots is done by holding down Shift while clicking (concurrent selection) or by holding down Ctrl while clicking (separate selection). The group box on the left contains information about the collar that was last clicked on (with a frame around it in the list on the left): The firmware string gives version number and date of the collar firmware. The three labels below (Activity, Temp., and Mortality) indicate the configuration of the collar: If a label is enabled (black font), then the corresponding option is active; if it is disabled (grey font), then the option is not available. In the example (Figure 140) only activity is active.

By clicking on the Read Data button the download is initiated. For each selected slot, a save file dialog will open with a filename suggestion. After all slots have been read, a message box will show up stating Terminal data memory read!. If none of the selected slots contained position data this is the only message you will get. No save dialog or anything else will then been shown.

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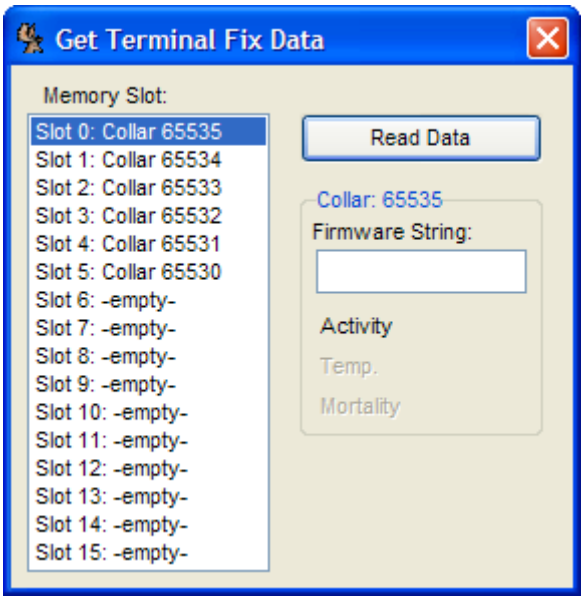

Figure 140: Get terminal fix data form

6.2.2 Export GPS Data in ASCII / Spreadsheet / Database

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 4.2.2 Export GPS Data. Please refer to this description. Because not all data is transmitted, some of the data in the exported file is marked as not available ("N/A").

6.2.3 GPS: View Data

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 4.2.3 View GPS Data. Please refer to this description. Because not all data is transmitted, some of the data in the exported file is marked as not available ("N/A").

6.2.4 GPS: Show Chart

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 4.2.4 Show GPS Chart. Please refer to this description.

6.2.5 Erase Fix Data

This command looks very similar to 6.2.1 Get Fix Data. Again, select the slots you want to erase and then press Erase Data. You will warned that data from the selected slots will be erased. If you answer the question with yes (you want to erase), a 20-second countdown will open. This is the last chance to cancel the erase procedure by pressing the ESC key or the clicking on the Cancel button on the countdown form.

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6.3 Activity Menu

The Activity menu includes commands needed to process the activity data downloaded with the Handheld Terminal or the collar directly.

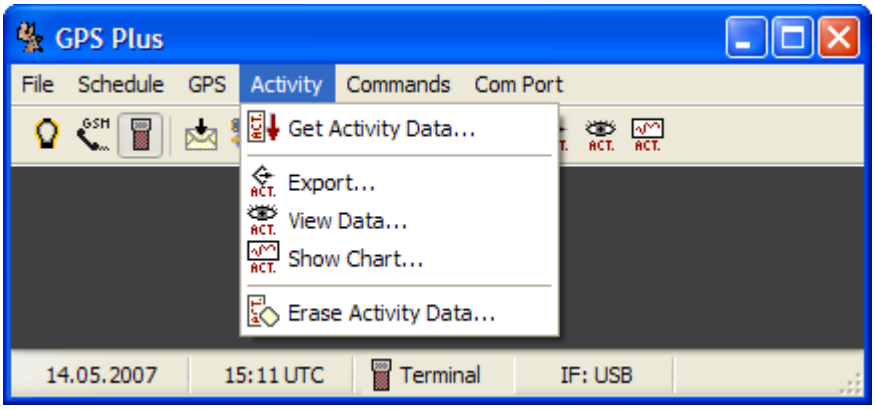

Figure 141: Main window with Activity menu open (GPS Base Station mode)

6.3.1 Get Activity Data

This command can also be accessed via the toolbar symbol shown to the left. It is similar to 6.2.1 Get Fix Data, except that it stores the corresponding activity data instead of the position data.

6.3.2 Export Activity Data

These commands can also be accessed via the toolbar symbols shown to the left. This is equivalent to 4.3.2 Export Activity Data. Please refer to this description.

6.3.3 Activity: View Data

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 4.3.3 Activity: View Data. Please refer to this description.

6.3.4 Activity: Show Chart

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 4.3.4 Activity: Show Chart. Please refer to this description.

6.3.5 Erase Activity Data

This is equivalent 4.3.5 Erase Activity Data. Please refer to this description.

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6.4 Commands Menu

In the *Commands* menu are commands for the control of the Handheld Terminal and for terminal testing.

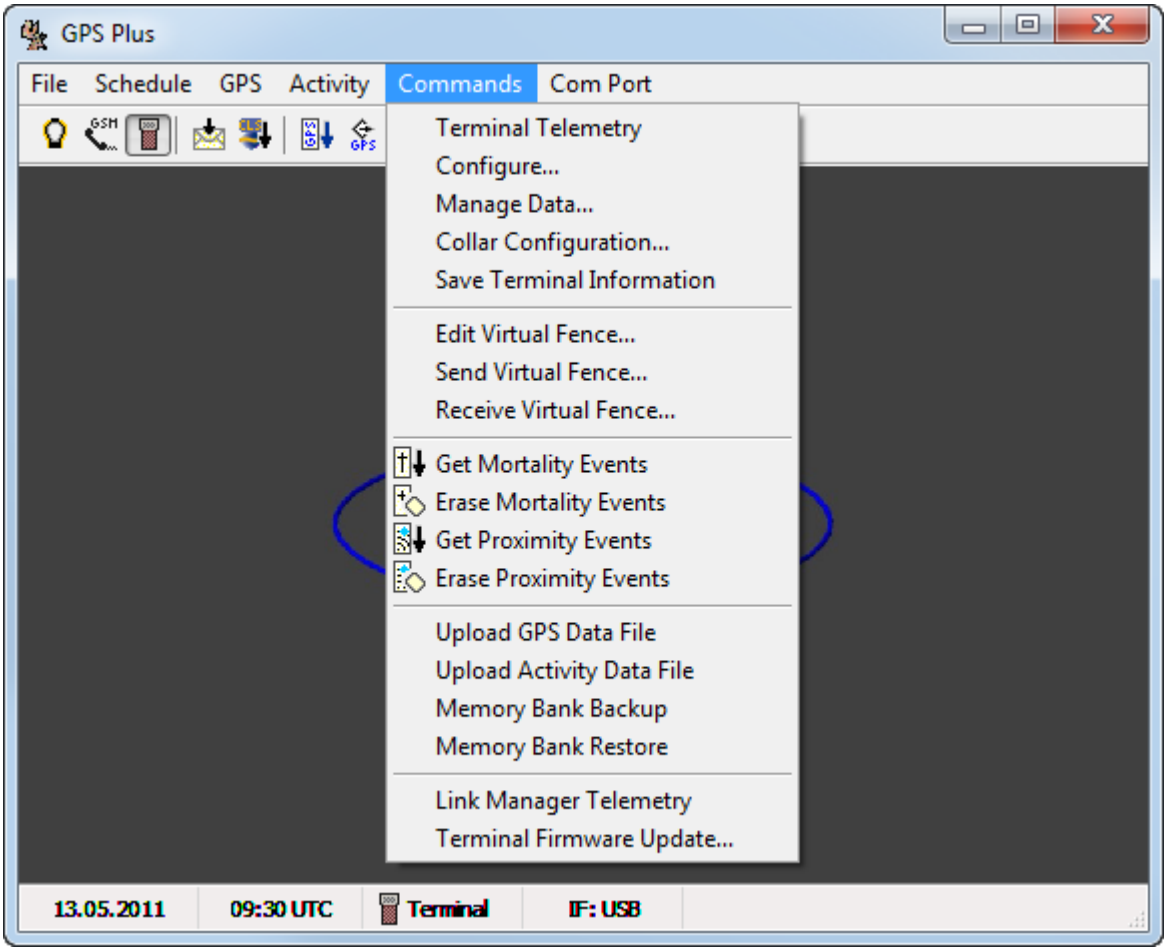

Figure 142: Main window with Commands menu open (Terminal mode)

6.4.1 Terminal Telemetry

This command opens the window shown in Figure 142.

Date — current date on the terminal, usually set during a GPS fix

Time — current time on the terminal, usually set during a GPS fix

Version — Software Version of the terminal software

Date — Release date of the terminal software

Uplink — Frequency for the communication from the terminal to the collar

Downlink — Frequency for the communication from the collar to the terminal

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Voltage Current battery voltage. Below 3.3 Volt the terminal will probably not work.

Flag internal status information needed for debugging

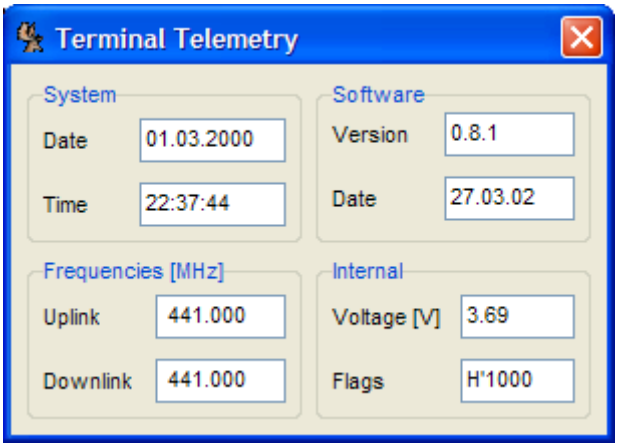

Figure 143: Terminal Telemetry window

6.4.2 Configure

The configuration of the Handheld Terminal contains only one item: Mark positions as "transmitted" in collar after receiving . If checked, the terminal will send a command to a collar that marks the received positions as transmitted. Positions in a collar marked as transmitted will not be transmitted again via GSM or Iridium.

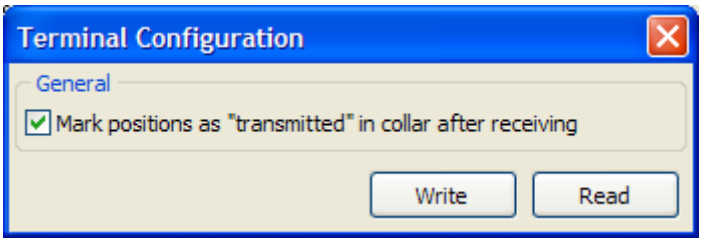

Figure 144: Terminal Configuration window

6.4.3 Manage Data

This command allows you to configure the Handheld Terminal for field work. The form is organised from left to right and contains three lists. The first list contains all collars that are registered on your computer. It should therefore contain the IDs of all your collars (except of those already selected). This list is stored in your computer and can contain up to 65535 entries. The second list (centre) contains the selected collars, that is all collars that you may want to check with your terminal. This list is stored in your terminal and can contain up to 64 entries. The third list shows the currently used collars organised in memory slots. These slots contain not only the information about the collars used but also the data (position, activity, mortality) retrieved from the collars and schedules that can be transmitted to the collar. The group box right to the list box shows data from the currently selected slot.

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Every time one of the lists is changed, the new configuration will be transferred to the terminal. This takes a few seconds while the program shows a message box. If you want to transfer several collar IDs it helps to select multiple collars by using the Ctrl and/or Shift while clicking on the list entries.

Select the collars you want to communicate with in the field moving them from the Registered Collars list to Selected Collars list. Just mark one or more collars in the Registered Collars list and click Select. Collars selected will be removed from the Registered Collars list and appear in the Selected Collars list. If you try to select more than 64 collars, the Select button will be disabled.

To remove collars from the Selected Collars list, mark them and press Unselect. The collars will disappear from the list and reappear in the Registered Collars list. If you try to unselect a collar that is in the Used Collars list, you will get a warning. Unselecting a collar that is used will also remove it from the Used Collars list, thus erasing the corresponding slot containing the data. The data in this slot will be lost. This is done for consistency reasons.

Transfers from the Selected Collars list to the Used Collars list can also be done on the Handheld Terminal. If you use more collars in the field than slots available in your terminal, it would be advisable to do so. However, if you want to completely configure your terminal before going into the field, select collars to be used by marking them in the Selected Collars list and press Use. Be aware that IDs may appear in both lists, Selected Collars as well as Used Collars, but only collars not already in the Used Collars list can be transferred.

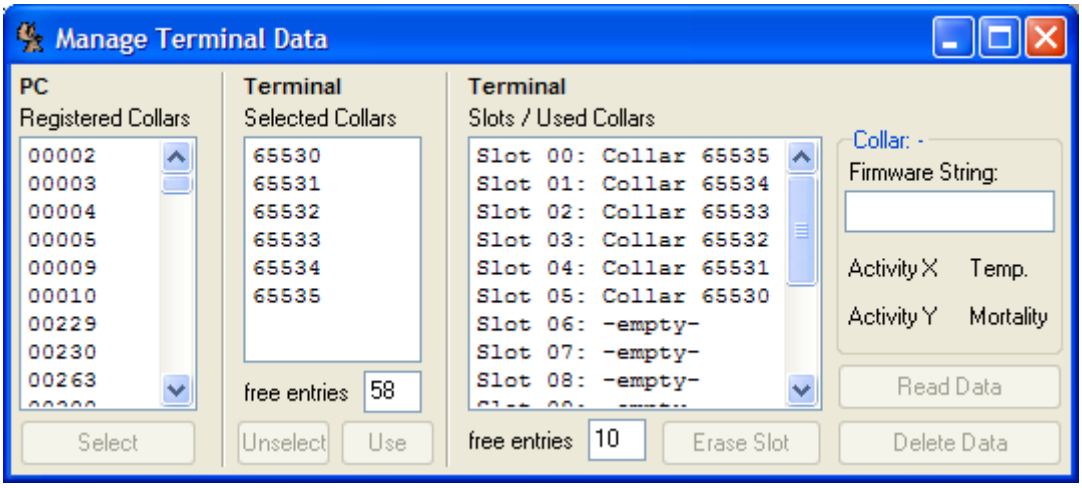

Figure 145: Manage Terminal Data form

To free one or more slots in the Used Collars list, select a slot and press Erase Slot. Be aware that this will erase all data contained in this slot! A message box with a warning will appear and if you confirm the command, a 20 second countdown will open. This is your last chance to cancel the command before all data will be erased.

Before erasing all data, you should save everything the slot contains. Mark one or more slots and press Read. The command is a combination of 6.2.1 Get Fix Data, 6.3.1 Read Activity Data, and 6.4.5 Get Mortality Events commands. Every GPS, activity, or mortality data set

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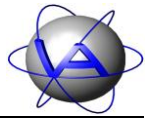

can be saved successively with a default filename based on the collar ID already set. After all slots are read, a final message box will appear. If no data sets are stored in the selected slots, only this message box appears. You may also delete the data of a slot without removing the ID of it by pressing Delete Data. No configuration information of the slot will be changed.

6.4.4 Save Terminal Information

With this command you can easily store the configuration data of the connected Handheld Terminal. After connection has been established, a *Save File* dialog will open. You can change the default name and path to your needs. Figure 146 gives an example of a terminal Information file.

```
Information file of Terminal No. 00029
Date of Readout 20.09.2004, 12:24:11
------------------------------------------------------
Terminal Date (UTC): 20.09.2004
Terminal Time (UTC): 10:23:17

Serial Number: 29
Software Version: 1.2.0
Software Date: 04.04.03
Hardware Version: 3
Production Date: 14.01.2004
```

Figure 146: Sample terminal information file

6.4.5 Get Mortality Events

This command allows you to read out mortality events from one or more memory slots of a Handheld Terminal. Its interface and handling is equivalent to 6.2.1 Get Fix.

6.4.6 Erase Mortality Events

This command allows you to erase mortality events from one or more memory slots of a Handheld Terminal. Its interface and handling is equivalent to that of 6.2.5 Erase Fix Data.

6.4.7 Upload GPS Data File

This command uploads a stored GPS Data File (.GDF) to a Handheld Terminal memory slot. After connection has been established, suitable files will be identified. A list of these files will be displayed in the form (see Figure 147). A file is considered suitable, if the containing collar ID is included in the Used Collars list of the terminal and thus has a memory slot assigned to it. The default folder for GDF files is the GPS Data directory.

You can now select one of the listed files. The collar ID and the corresponding memory slot will be displayed. Clicking Upload will transfer the data to the displayed memory slot in the

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Handheld Terminal. Be aware that the GPS data in this slot will be overwritten and thus be lost. Mortality and Activity data are not affected.

If you want to upload a GPS Data file for a collar which ID is not in the Used List, you first need to reconfigure the terminal and add the collar ID (see 6.4.3 Manage Data).

Figure 147: Upload GPS Data File (*.GDF) form

6.4.8 Upload Activity Data File

This command uploads a stored Activity Data File (.ADF) to a Handheld Terminal memory slot. It is equivalent to 6.4.7 Upload GPS Data File but with another file extension.

6.4.9 Memory Bank Backup

With this command, you can back-up the collar data collected in your Handheld Terminal. The command will store the following data to a file: All in your terminal available collars, all selected collars and their configuration (only available if received from a collar), and all the collected data.

A *Save File* dialog will open. You can choose the name yourself, but the extension is always MBI (Memory Bank Image). A double progress bar will appear (see Figure 148). The top one indicates the progress of the entire backup process and the lower one the progress of the current memory slot (containing the data of one collar) back-up. The file size depends on the number of memory banks installed: One bank will result in a file of about 61 Megabytes, two banks will lead to 122 Megabytes.

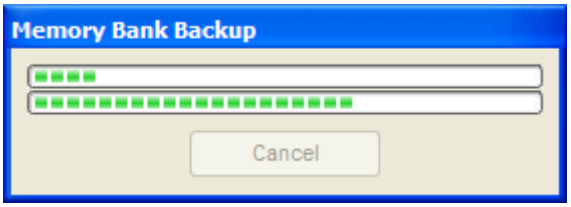

Figure 148: Memory bank backup progress bars at about 20% progress

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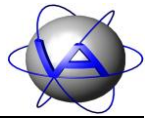

The back-up takes about 20 minutes using USB with only one memory bank installed! Having both memory banks installed doubles the time, using the serial interface (via Link Manager LM1) takes even longer.

6.4.10 Memory Bank Restore

With this command, you can restore a backup to your Handheld Terminal. The command will restore the data from a file created with the Memory Bank Backup command (see chapter 6.4.9) to your terminal. All data collected in the terminal will be overwritten!

An *Open File* dialog will open and you need to select a file. The extension is always MBI (Memory Bank Image). A double progress bar will appear as when creating the backup. The upper indicates the progress of the whole restore process and the lower the progress of the current memory slot (containing the data of one collar). Since the terminal can be equipped either with one or two memory banks it may happen that you want to restore a backup of two banks into a terminal with only one or vice versa. The program will recognise that and warn you. You may then continue or cancel the restore process.

If you are trying to restore a one-bank file to a two-bank terminal only, bank one will be overwritten. This may lead to double entries of one collar. In this case, only the first entry (in bank one) will be used when downloading data via RF from a collar to the terminal. The second entry will still be available for data download from the terminal to the PC. Be aware that the Used Collars list will be overwritten completely. This may bring collars into the Used Collars list although they are not in the Selected Collars list. You can continue to use the collars in the Used Collars list even if they are not in the Selected Collars list, but if you remove them from the Used Collars list, you need to configure them again via the GPS Plus software.

If you try to restore a two-bank file to a one-bank terminal only, the first 16 entries (first bank) of the file will be restored and only bank one in the terminal will be overwritten. You will not be able to restore all data of a two-bank file to a one-bank terminal.

Restore of one memory bank takes 2 hours using USB! Restoring two memory banks doubles the time, using the serial interface (via Link Manager LM1) takes even longer.

6.4.11 Link Manager Telemetry

This is equivalent to 4.4.24 Link Manager Telemetry. Please refer to this description.

6.4.12 Firmware Update

This is equivalent to 4.4.23 Collar Firmware Update. Please refer to this description.

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6.5 Com Port Menu

This is equivalent to 4.5 Com Port Menu. Please refer to this description.

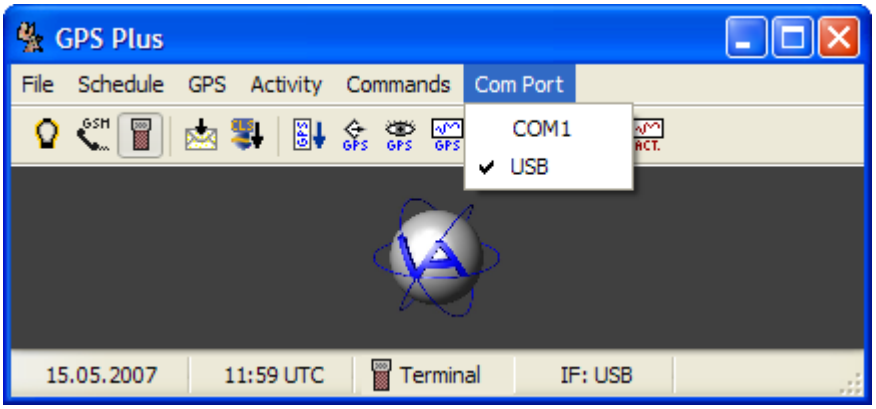

Figure 149: Main window with Com Port menu open (Terminal mode)

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7 Handheld Terminal Mode (FW later than 2.x)

ATTENTION: There have been a lot of changes in the Handheld Terminal firmware in version 2.x and higher compared to earlier versions. Therefore, some commands differ in GPS Plus. If your Handheld Terminal has a firmware earlier than 2.x, please refer to 6 Handheld Terminal Mode (FW before 2.x)

In this mode the program can be used to read data from a Handheld Terminal and configure it. The data can be exported or displayed as a graph.

7.1 Schedule Menu

These command is identical to 6.1 Schedule Menu. Refer to this chapter for reference.

7.1.1 Create GPS Schedule

This command is identical to 4.1.1 Create GPS Schedule. Refer to this chapter for reference.

7.1.2 Create Beacon Schedule

This command is identical to 4.1.2 Create Beacon Schedule. Refer to this chapter for reference.

7.1.3 Lifetime Calculation

This command is identical to 4.1.5. Refer to this chapter for reference.

7.1.4 Send GPS Schedule

This command allows you to upload GPS rule files (.GRF) to collars configured on the Handheld Terminal so that you can later send them via RF to the terminal.

All you have to do is to selected a GPS rule file (.GRF) by clicking on Select and a collar from the terminal's Collar drop down list. The list contains all collars configured on the terminal. If you do not find the collar ID, you need to configure it first (see 7.4.2 Manage Data). After you have selected the appropriate schedule and collar ID, press Send and the schedule will be transferred to the terminal.

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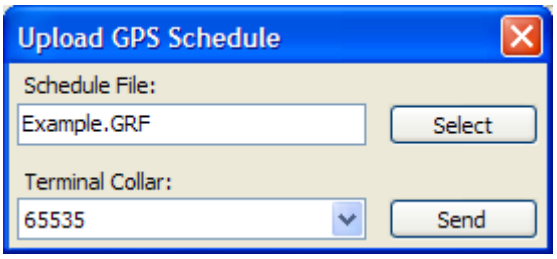

Figure 150: Send Terminal GPS Schedule main window (FW >= 2.X)

7.1.5 Send VHF Beacon Schedule

This command is identical to 7.1.4 Send GPS Schedule command. Refer to this chapter for reference.

7.1.6 Send Proximity Schedule (firmware 2.3.1 or higher)

This command is equivalent to 7.1.4 Send GPS Schedule.

7.1.7 Send GSM/Iridium Schedule (firmware 2.3.1 or higher)

This command allows you to send a GSM/Iridium schedule to a Handheld Terminal. Press Select to load a GSM/Iridium schedule file (.GSF) into the form. Select a collar ID from the Terminal Collar drop down list. This list only contains collars that are registered on the terminal. If you want to upload a GSM/Iridium schedule for an unregistered collar, you first need to configure the terminal (see 6.4.3 Manage Data). You can only upload the schedule for one collar in this process, repeat it if you need to upload schedules for more than one collar.

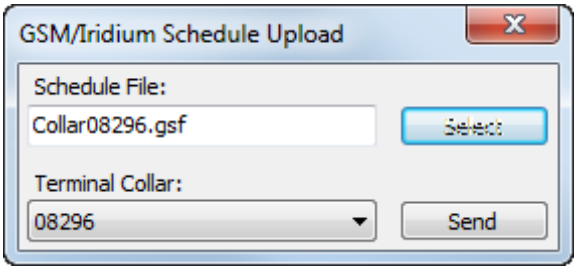

Figure 151: Upload GSM/Iridium Schedule dialog

7.1.8 Receive GPS/Iridium Schedules

To check the GPS schedules stored on a Handheld Terminal, they can be downloaded. A Window will open while waiting for connection with the terminal. If no connection can be established, the command will be aborted. After connection has been established the main window for the download will appear (see Figure 152).

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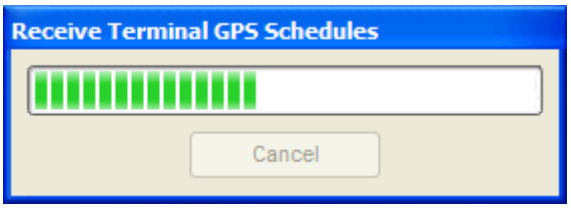

Figure 152: Receive Terminal GPS Schedules main window

Now the data from all registered collars will be read and stored as file in the Schedule Files directory as `TerminalGPSSchedules.txt`. The file contains as many entries as there are registered collars in the terminal. Figure 153 shows an exemplary excerpt of such a file.

```
Terminal 00196 GPS Schedules of Collars
Read at 10:21:51, 15.05.2007
=====================================

Collar 65530:
-------------
14.12.2006 - 14.12.2007 @ 09:00:00; 11:00:00; 13:00:00; 15:00:00; 17:00:00
14.04.2007 - 14.08.2007 @ 05:00:00; 07:00:00; 19:00:00; 20:00:00
14.12.2007 - 21.12.2007 & 06:30:00 - 22:00:00 # 01:00:00
22.12.2007 - 15.12.2008 & 06:00:00 - 18:00:00 § 06:15:00

Collar 65531:
-------------
- rules not active -

Collar 65532:
-------------
- rules not active -

Collar 65533:
-------------
- no collar information block available -

Collar 65534:
-------------
- no collar information block available -

Collar 65535:
-------------
- rules not active -
```

Figure 153: Terminal GPS schedules file example

If a GPS schedule for this collar have been saved on the terminal, it will be displayed as is shown for collar 65530. If no GPS schedule has been saved for a collar, two different status messages can be displayed.

After data from a collar has been saved on the terminal, or a schedule for this collar has been uploaded to the terminal from your computer, an information block for this collar is created. The status message `no collar information block available` means that though the collar has been registered on the terminal, there is no data or information stored on the terminal yet.

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If `rules not active` is shown, an information block is available on the terminal for the collar, but no GPS schedule has been saved. This would be the case e.g. if data have been downloaded from the collar, but no schedule has been saved on the terminal.

7.1.9 Receive VHF Beacons Schedule

This command is almost identical to 7.1.6 Receive GPS Schedules . Only the filename differs: The file is stored as `TerminalVHFSchedules.txt`.

7.1.10 Receive Proximity Schedules (Handheld Terminal firmware 2.3.1 or higher)

This command is equivalent to 7.1.8 Receive GPS Schedule. The file is stored as `TerminalProximitySchedules.txt`. Note: Proximity schedules will be stored with the same file name as standard GPS schedules, so please change the name of the file including the standard GPS schedules.

7.1.11 Receive GSM/Iridium Schedules (Handheld Terminal firmware 2.3.1 or higher)

This command is almost identical to 7.1.8 Receive GPS Schedules, but the file will be is stored as `TerminalGSMSchedules.txt`.

7.2 GPS Menu

In the GPS menu are commands concerning the stored position data of all sources.

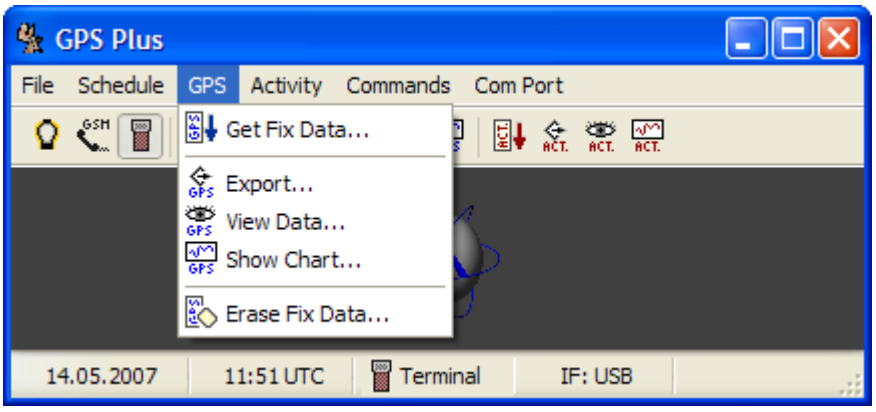

Figure 154: Main window with GPS menu open (Terminal mode)

7.2.1 Get Fix Data

This command can also be accessed via the toolbar symbol shown to the left. This command will bring you to the Manage Data form (see chapter 7.4.3 Manage Data).

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7.2.2 Export GPS Data in ASCII / Spreadsheet / Database

These commands can also be accessed via the toolbar symbols shown to the left. It is equivalent to 4.2.2 Export GPS Data. Please refer to this description. Since not all data is transmitted (e.g. not DOP), some of the data in the exported file is marked as not available ("N/A").

7.2.3 GPS: View Data

This command can also be accessed via the toolbar symbol shown to the left. It is equivalent to 0 View GPS Data. Please refer to this description. Because not all data is transmitted, some of the data in the exported file is marked as not available ("N/A").

7.2.4 GPS: Show Chart

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 0 Show GPS Chart. Please refer to this description.

7.2.5 Erase Fix Data

This command looks very similar to 0 Manage Data. Again, select the slots you want to erase and then press Erase Data. You will be warned that data from the selected slots will be erased. If you answer the question with yes (you want to erase), a 20-second countdown will open. This is the last chance to cancel the erase procedure by pressing the ESC key or the clicking on the Cancel button on the countdown form.

7.3 Activity Menu

In the *Activity* menu are commands concerning the stored activity data of all sources.

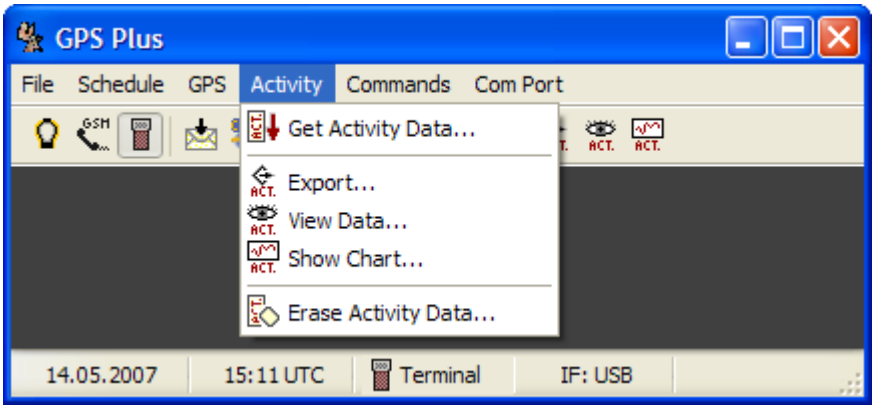

Figure 155: Main window with Activity menu open (Handheld Terminal mode)

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7.3.1 Get Activity Data

This command can also be accessed via the toolbar symbol shown to the left. It will open the Manage Data form (see chapter 7.4.3 Manage Data).

7.3.2 Export Activity Data

This command can also be accessed via the toolbar symbols shown to the left. This is equivalent to 4.3.2 Export Activity Data. Please refer to this description.

7.3.3 Activity: View Data

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 4.3.3 Activity: View Data. Please refer to this description.

7.3.4 Activity: Show Chart

This command can also be accessed via the toolbar symbol shown to the left. This is equivalent to 4.3.4 Activity: Show Chart. Please refer to this description.

7.3.5 Erase Activity Data

This is equivalent to 7.2.5 Erase Fix Data. Please refer to this description.

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7.4 Commands Menu

In the Commands menu are commands for the control of the Handheld Terminal and for terminal testing.

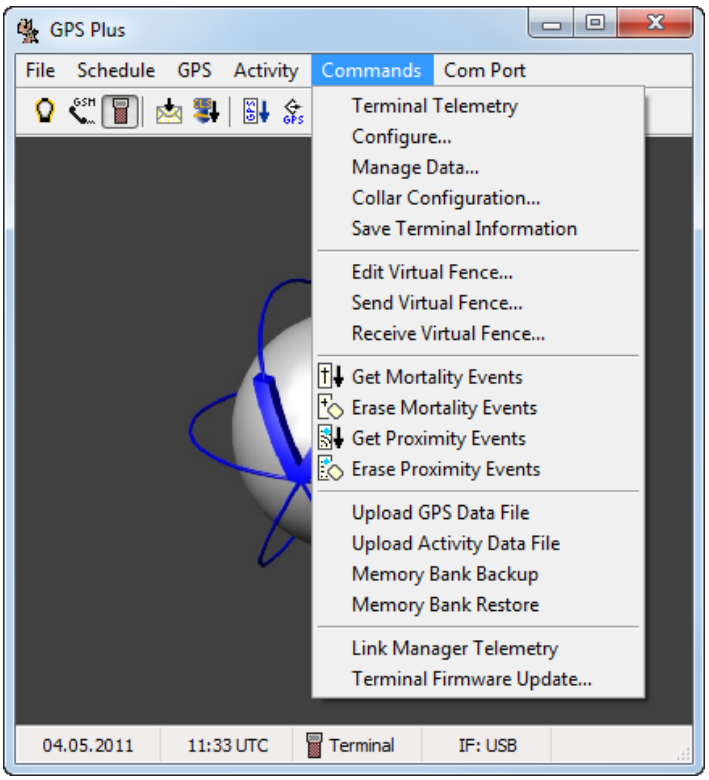

Figure 156: Main window with Commands menu open (Terminal mode)

7.4.1 Terminal Telemetry

This command is identical to 6.4.1 Terminal Telemetry. Please refer to this description.

7.4.2 Configure

This command is equivalent to 7.4.2 Configure.

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7.4.3 Manage Data

This command allows you to configure the Handheld Terminal for field work and retrieve data after collecting it from the collars in the field.

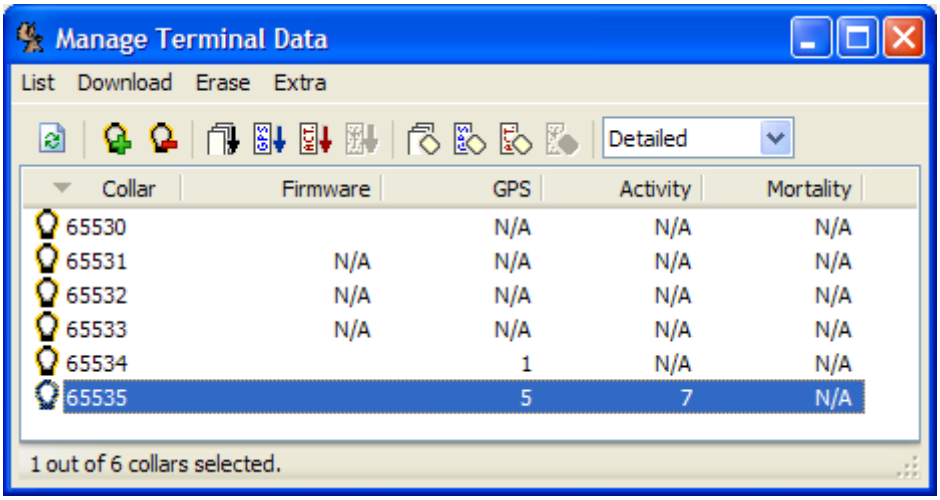
Manage Terminal Data
List Download Erase Extra
Detailed
Collar Firmware GPS Activity Mortality
65530 N/A N/A N/A
65531 N/A N/A N/A N/A
65532 N/A N/A N/A N/A
65533 N/A N/A N/A N/A
65534 1 N/A N/A
65535 5 7 N/A
1 out of 6 collars selected.

Figure 157: Manage Terminal Data form

The form contains main menu, toolbar, collar list, and status bar. The list contains all collars that are already registered in the terminal. It shows the collar ID, the firmware version, and the number of pages with GPS, Activity, and Mortality data retrieved from the collar via RF.

You can execute commands on selected collars. To select a collar, just click on it. To select multiple collars, use Shift to mark a range and Ctrl to add single collars to other selected collars.

7.4.3.1 List - Reload List

This command can also be accessed via the toolbar symbols shown to the left. It reads all collar information from the terminal. No sensor data will be transmitted. A form will open, listing all collars registered in GPS Plus (on how to register a collar see 3.1.6 Collar List). Select the collars you want to use and press OK. The collars will then be configured in the terminal and the list will be reloaded.

7.4.3.2 List – Add Collar(s)

This command can also be accessed via the toolbar symbols shown to the left. It allows you to add one or more collars to the terminal. A form will open, listing all collars registered in GPS Plus (on how to register a collar see 3.1.6 Collar List). Select the collars you want to use and press the OK button. The collars will then be configured in the terminal and the list will be reloaded.

7.4.3.3 List - Remove Collar(s)

This command can also be accessed via the toolbar symbols shown to the left. It allows you to remove collars from the terminal. Note: This will also erase the data of these collars from the terminal. There is no way of restoring these data. Select one or more collars

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from the list and submit the command. A warning will open, requesting an acknowledgement to erase the selected collars. The list will be updated while the selected collars are removed.

7.4.3.4 Download - Read all Data

This command can also be accessed via the toolbar symbols shown to the left. It reads all available data from the selected collars. It will automatically use default filenames for the data files, you cannot select you own file names and folders. For example, the filenames for collar 65535 are: `Collar65535YYMMDDHHMMSS.GDF`[1] in the GPS Data folder for the GPS data, `Collar65535 YYMMDDHHMMSS.ADF` in the Activity Data folder for the activity data, and `MortalityEvents65535YYMMDDHHMMSS.TXT` in the Mortality Files folder for the mortality data. For empty data, no file will be created.

7.4.3.5 Download - Read GPS Data

This command can also be accessed via the toolbar symbols shown to the left. It reads the GPS fix data of the currently selected collars. For every selected collar, a *Save File* dialog with a suggestion for the name will open. After selecting a file name, a progress bar will open while the data download of the current collar is in progress.

7.4.3.6 Download - Read Activity Data

This command can also be accessed via the toolbar symbols shown to the left. It reads the activity data of the currently selected collars. For every collar selected, a *Save File* dialog with a suggestion for the name will open. After selecting a file name, a progress bar will open while the data download of the current collar is in progress.

7.4.3.7 Download - Read Mortality Data

This command can also be accessed via the toolbar symbols shown to the left. It reads the mortality data of the currently selected collars. For every collar selected, a *Save File* dialog with a suggestion for the name will open. After selecting a filename, a progress bar will open while the data download of the current collar is in progress.

7.4.3.8 Download - Read Proximity Data

This command can also be accessed via the toolbar symbols shown to the left. It reads the proximity data of the currently selected collars. For every collar selected, a *Save File* dialog with a suggestion for the name will open. After selecting a filename, a progress bar will open while the data download of the current collar is in progress.

7.4.3.9 Erase - Erase All Data

This command can also be accessed via the toolbar symbols shown to the left. It erases all data of the currently selected collars in the terminal. A warning will open, requesting an acknowledgement to erase the data of the selected collars. Since erasing is working much faster than reading, no progress bar, but a message window will be shown while in progress.

[1] `YYMMDDHHMMSS` stands for year (Y), month (M), day (D), hour (H), minute (M), second (S)

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7.4.3.10 Erase - Erase GPS Data

This command can also be accessed via the toolbar symbols shown to the left. It erases the GPS fix data of the currently selected collars in the terminal. A warning will open, requesting an acknowledgement to erase the data of the selected collars. Since erasing is working much faster than reading, no progress bar, but a message window will be shown while in progress.

7.4.3.11 Erase - Erase Activity Data

This command can also be accessed via the toolbar symbols shown to the left. It erases the activity data of the currently selected collars in the terminal. A warning will open, requesting an acknowledgement to erase the data of the selected collars. Since erasing is working much faster than reading, no progress bar, but a message window will be shown while in progress.

7.4.3.12 Erase - Erase Mortality Data

This command can also be accessed via the toolbar symbols shown to the left. It erases the mortality data of the currently selected collars in the terminal. A warning will open, requesting an acknowledgement to erase the data of the selected collars. Since erasing is working much faster than reading, no progress bar, but a message window will be shown while in progress.

7.4.3.13 Erase - Erase Proximity Data

This command can also be accessed via the toolbar symbols shown to the left. It erases the proximity data of the currently selected collars in the terminal. A warning will open, requesting an acknowledgement to erase the data of the selected collars. Since erasing is working much faster than reading, no progress bar, but a message window will be shown while in progress.

7.4.3.14 Extra - Format Flash Memory

This command is available from the List menu only. It formats the flash memory of the terminal. This is the place, where all data is stored. Note: This command will erase all collected data and configured collars in the terminal! There is no way to restore erased data.

7.4.3.15 Change View of Collar List

This command is available from the toolbar only. It toggles between Detailed View (as shown in Figure 157) and Icons View (Figure 158). No details on the collars are shown in Icons View, but you can select collars as in Detailed View.

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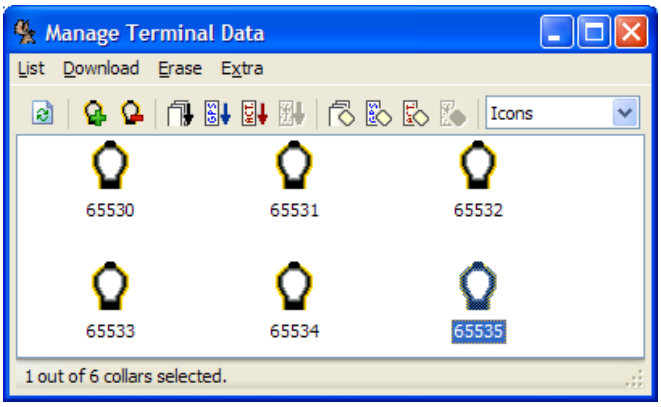

Figure 158: Icons View

7.4.4 Collar Configuration (Handheld Terminal firmware 2.3.1 or higher)

This command allows you to upload configuration files which can be sent to a collar to change certain parameters. You can store up to five configuration for one collar on the Handheld Terminal. In this form, there is no verification if the configured parameter is enabled in the receiving collar. Hence you are able to define configurations which will not be applied in your collar.

First select the Collar ID from the drop off list. You can open the configuration files currently stored on the terminal for the selected collar with Read. After you have defined the new configurations, send them to the terminal with Write.

Choose the Parameter from the drop down list. The Listed Name will be shown on the terminal when you prepare the upload from the terminal to the collar. Depending on the parameter you configure, different input fields will be shown:

UTC Correction: enables the UTC correction in your collar (see 4.4.3.1 UTC Correction). Select the checkbox and set a correction with the up/down arrows.

RF Communication Time: Defines the UHF/VHF data communication window (see 4.4.3.7 RF Communication Time). Set an Enable Time and Disable Time with the up/down arrows.

Virtual Fence Events: Defines whether you are notified by GSM or Iridium whenever the collar enters and/or leaves a Virtual Fence. It also defines an optional interval after which the message is repeated to ensure reception (see 4.4.3.15 Virtual Fence Events).

Configuration File: You can send a configuration file to the collar to activate certain features, e.g. sensors. These files are supplied by Vectronic. Each configuration file is valid for one collar only. Please make sure that you upload the correct configuration file.

Proximity Mode: Enables or disables the proximity sensor (see 4.4.3.14 Proximity Sensor).

Proximity Interval: Defines the Listen Interval of the proximity sensor and can be set in eight second steps (see 4.4.3.14 Proximity Sensor).

Proximity Listen Duration: Defines the Listen Interval of the proximity sensor (see 4.4.3.14 Proximity Sensor).

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Proximity Active Time: Defines the time of day in which the proximity sensor is active (see 4.4.3.14 Proximity Sensor).

Proximity Receiver Frequency: Defines the frequency on which the proximity sensor is listening for ID tags (see 4.4.3.14 Proximity Sensor).

Proximity Disable Schedule: Disables a proximity schedule that is already on the collar (see 4.4.3.14 Proximity Sensor).

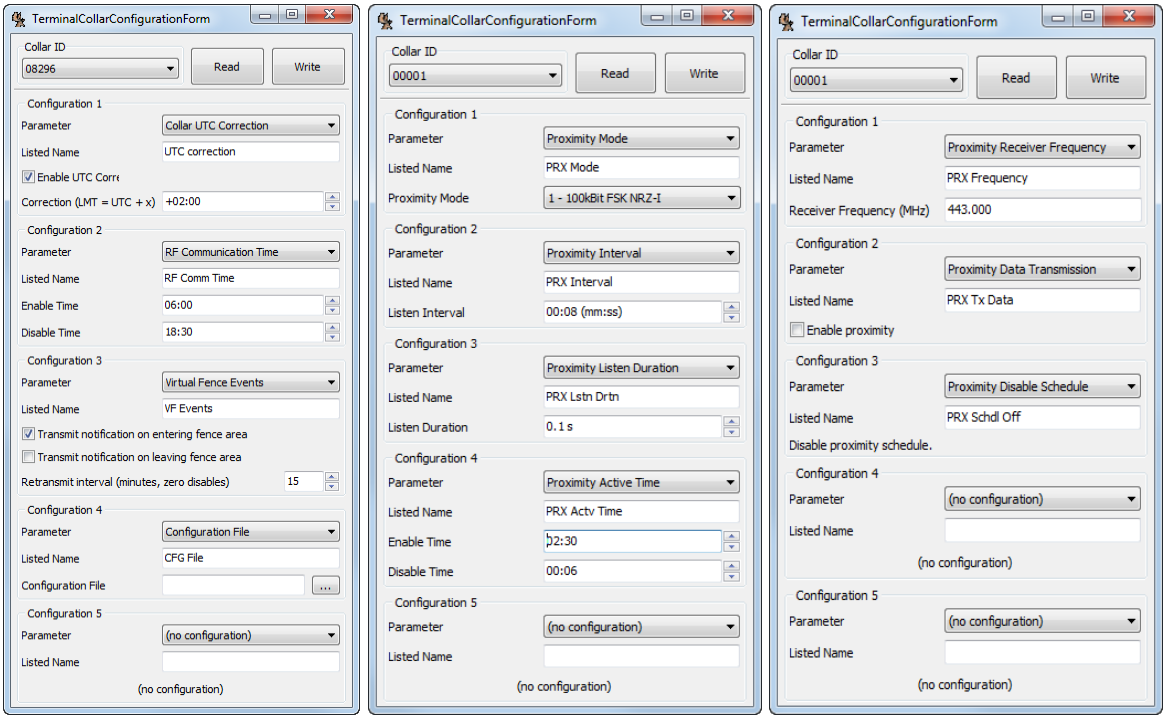

Figure 159: Three examples showing all possible parameters to be transferred via Handheld Terminal

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7.4.5 Save Terminal Information

With this command you can easily store all configuration data of the connected Handheld Terminal. After connection has been established, a *Save File* dialog will open. You can change the default name and path to your needs. An example of such a file is given in Figure 160.

```
Information file of Terminal No. 00229
Date of Readout                  23.06.2011, 09:16:42
-----------------------------------------------------
Terminal Date (UTC):   23.06.2011
Terminal Time (UTC):   07:11:47

Serial Number:         229
Software Version:      2.3.3
Software Date:         19.04.11
Hardware Version:      4
Production Date:       02.04.2007

Uplink Frequency:      441.000 MHz
Downlink Frequency:    441.000 MHz

Mark Positions:        False
```

Figure 160: Terminal Information file

7.4.6 Edit Virtual Fence

This command will open the Virtual Fence editor. It is equivalent to 4.4.8 Edit Virtual Fence.

7.4.7 Send Virtual Fence

This command will send a Virtual Fence Collection (.VFC) to the Handheld Terminal to send it to a collar. It is equivalent to 4.4.9 Send Virtual Fence.

7.4.8 Receive Virtual Fence

This command will read a Virtual Fence Collection (.VFC) stored on a Handheld Terminal. It is equivalent to 4.4.10 Receive Virtual Fence.

7.4.9 Get Mortality Events

This command will open the Manage Terminal Data form (see 7.4.2.7 Read Mortality Data).

7.4.10 Erase Mortality Events

This command will open the Manage Terminal Data form (see 7.4.2.11 Erase Mortality Data).

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7.4.11 Get Proximity Events

This command will open the Manage Terminal Data form (see 7.4.3.7 Read Proximity Data).

7.4.12 Erase Proximity Events

This command will open the Manage Terminal Data form (see 7.4.3.13 Erase Proximity Data).

7.4.13 Upload GPS Data File

This command opens the more general Upload Sensor Data form (see Figure 161). It can upload a stored GPS Data File (*.GDF) to a collar configured in the Handheld Terminal. After connection has been established, suitable files will be identified. A list with these files will be displayed in the form. A file is considered suitable, if the containing collar ID is also configured in the terminal. You can change the folder, in which the files will be searched. The default folder is the GPS Data directory.

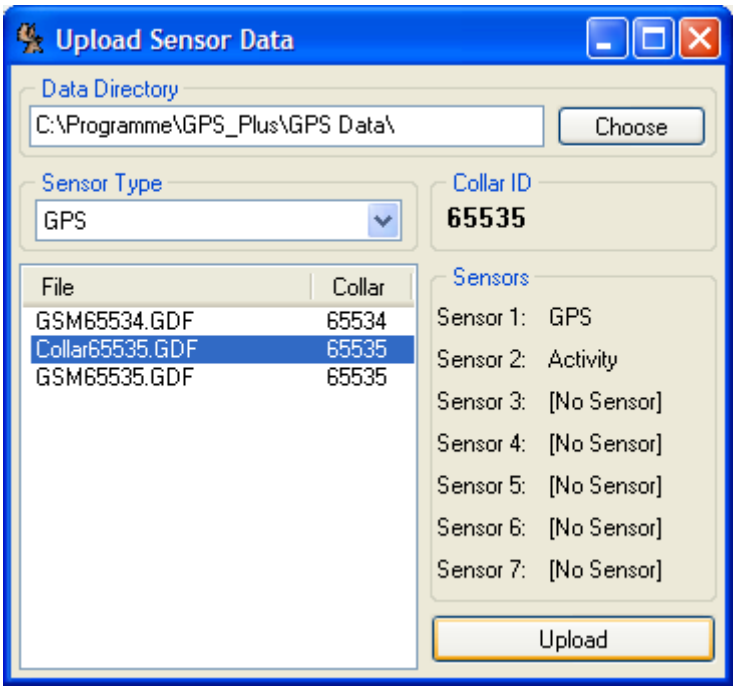

Figure 161: Upload Sensor Data form

You can now select one of the listed files. The collar ID and the sensors already in use in the terminal by this collar are displayed on the right. Click Upload to transfer the data to the terminal. **Be aware that the data of the same sensor type of this collar in the terminal will be overwritten and thus be lost.** Only the GPS Data will be overwritten. Other sensors will not be touched. To upload a GPS Data File with a collar ID that is not in the used list, you need to configure the terminal (see 7.4.3.2 Add Collar(s)).

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7.4.14 Upload Activity Data File

This command uploads a stored Activity Data File (.ADF) to a Handheld Terminal memory slot. It is equivalent to 7.4.7 Upload GPS Data File.

7.4.15 Memory Bank Backup

Since the new Handheld Terminal organises its flash memory more like a file system, this command is not implemented. Instead you can store selected collar data from the terminal (see 7.4.3 Manage Data).

7.4.16 Memory Bank Restore

Since the new Handheld Terminal organises its flash memory more like a file system this command is not implemented for it. Instead, you can upload selected collar data to the terminal (see 7.4.6 Upload Activity Data File and 7.4.15 Memory Bank Backup).

7.4.17 Link Manager Telemetry

This is equivalent to 4.4.24 Link Manager Telemetry. Please refer to this description.

7.4.18 Terminal Firmware Update

This is equivalent to 4.4.23 Collar Firmware Update. Please refer to this description.

7.5 Com Port Menu

This is equivalent to the 4.5 Com Port Menu. Please refer to this description.

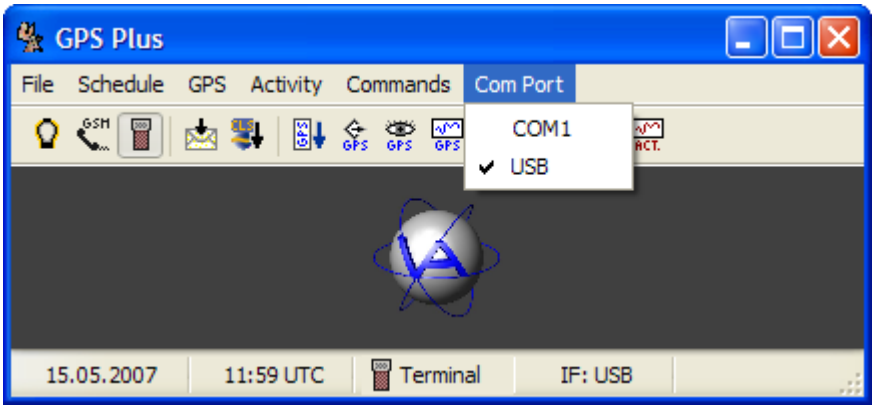

Figure 162: Main window with Com Port menu open (Terminal mode)

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Appendix A: Error messages

These are the error messages you may encounter using the GPS Plus software. The text of the error message is given in bold letters, followed by an explanation of the error and instruction on how to proceed.

Activity Chart: Incorrect input file format! File [file name] has not been read.

The data format of the selected file could not be read. The file seems to be corrupted or you selected a file that is not an activity data file.

Activity Data File Upload: Failed to upload data! Collar ID was not valid.

The ID stored in the file is not valid. Either this file is not a regular collar file or it is corrupted.

Activity Data File Upload: Failed to upload data! Data in destination Slot may be inconsistent. Please try again or erase slot.

The upload of position data to a terminal memory slot failed. The data may be partly written and therefore it may be inconsistent. It is strongly recommended to erase the slot or to write the data again to the same slot.

Activity Data File Upload: Failed to upload data! Destination slot contains differential data, while selected file contains solved data. Please erase slot and select collar ID for it again.

The program cancelled the upload of position data to a terminal memory slot because the configuration of the slot did not match that of the data.

Activity Data File Upload: Failed to upload data! Destination slot contains solved data, while selected file contains differential data. Please erase slot and select collar ID for it again.

The program cancelled the upload of position data to a terminal memory slot because the configuration of the slot did not match that of the data.

Activity Data File Upload: Failed to verify data! Do you want to retry reading this data or cancel transmission overall?

The data received from the terminal is not the same as the date previously written. You may retry to read the data or cancel the whole operation.

Calculate Collar Lifetime: Schedule Rules are corrupted! A Start Date is later than an End Date. Rule: [rule string]

A rule has a starting date this is later than an end date. This is not allowed.

Collar Firmware Update: Collar and file type do not match! Please use an appropriate file for this collar.

Depending on the collar version, different processors are used. The file selected did not match the collars processor.

Collar Firmware Update: Could not check Chip Signature of Collar! Maybe no collar is connected.

The program tried to read type information from the collar but failed.

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Collar Firmware Update: Firmware File CRC is not correct! [expected CRC] <> [computed CRC]

The selected file seems to be corrupted. Please use another file.

Collar Firmware Update: Firmware File Name is not correct! It does not start with "GPS_____" or "GPSPLUS_"!

The file you selected as a collar firmware file is not accepted as such, because of its file name.

Collar Interface: Collar is not in standby mode! Maybe no magnet is attached to collar.

"Not in standby mode" means the program received a status byte which indicates that the collar is doing something else but waiting. In this case, communication is not possible. Connecting a magnet to the collar will force the collar to stay in standby mode but will not put it directly in standby mode. You can monitor the status in the status window (see 4.4.4 Collar Status) and wait until the collar is in standby mode.

Collar Interface: Could not connect to Link Manager!

Invalid Handle
or **Device Not Found**
or **Device Not Opened**
or **General IO Error**
or **Insufficient Resources**
or **Invalid Parameter**

The program failed to connect to the Link Manager via USB. If the Link Manager was not found, but is connected, you should disconnect the Link Manager and close the program. Then re-connect it and start GPS Plus again.

Collar Interface: CRC was not correct. Read EEPROM Byte was not successful!

The data received by the program was inconsistent. This is mostly due to a transmission error on the serial line. Just try again.

Collar Interface: CRC was not correct. Read Firmware Page was not successful!

The data received by the program was inconsistent. This is mostly due to a transmission error on the serial line. Just try again.

Collar Interface: CRC was not correct. Read Flash Page was not successful!

The data received by the program was inconsistent. This is mostly due to a transmission error on the serial line. Just try again.

Collar Interface: CRC was not correct. Transfer was not successful!

The data received by the program was inconsistent. This is mostly due to a transmission error on the serial line. Just try again.

Collar Interface: No contact within 10 seconds! Maybe no collar is connected.

This error occurs if the collar does not send a status byte within ten seconds. Normally, it should send a status byte at least every eight seconds. The most probable cause is that the collar is not connected. Just connect and try again.

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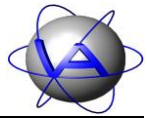

Collar Interface: No port open! Please select a valid one.

You have not yet selected a Com Port for the given device that can be used by the program. Choose one via the Com Port menu.

Collar Interface: Not all data was received within time. Read EEPROM Byte was not successful!

The program expected to receive more data from the collar. Maybe your computer is too busy and lost one or more bytes of the transmission. If you have other applications running which may take time for the computer to process please close them and try again.

Collar Interface: Not all data was received within time. Read Firmware Page was not successful!

The program expected to receive more data from the collar. Maybe your computer is too busy and lost one or more bytes of the transmission. If you have other applications running which may take time for the computer to process please close them and try again.

Collar Interface: Not all data was received within time. Read Flash Page was not successful!

The program expected to receive more data from the collar. Maybe your computer is too busy and lost one or more bytes of the transmission. If you have other applications running which may take time for the computer to process please close them and try again.

Collar Interface: Not all data was received within time. Transfer was not successful!

The program expected to receive more data from the collar. Maybe your computer is too busy and lost one or more bytes of the transmission. If you have other applications running which may take time for the computer to process please close them and try again.

Collar Interface: Not all data was sent. Write EEPROM Byte was not successful!

The program has not been able to send the complete data-block of the command.

Collar Interface: Not all data was sent. Write Firmware Page was not successful!

The program has not been able to send the complete data-block of the command.

Collar Interface: Not all data was sent. Write Flash Page was not successful!

The program has not been able to send the complete data-block of the command.

Collar Interface: Timeout: No Echo from Collar!

The sent character was expected to be echoed but no echo was received within timeout.

Collar Interface: Unknown interface ID!

You probably will never encounter this error. The message is intended to help VECTRONIC with debugging.

Collar Interface: USB Communication Failed! Could not send Command.

The program failed to send a command to the terminal via the USB.

Collar Interface: Wrong Echo from Collar! [expected value] <> [received value]

The sent character was expected to be echoed but the echo differed from it.

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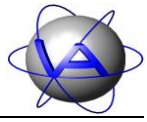

Collar Interface:
Could not close serial interface!
or **Could not set buffer size!**
or **Could not set communication settings!**
or **Could not set flow control settings!**
or **Could not set timeout parameters!**
or **Could not use this Serial Port!**
or **Unknown interface ID!**

These are errors resulting from initialising the communication interface of the Collar (Link Manager). The program was not able to open the serial port. This can be due to several reasons: The port you tried is already in use or the port does not exist on your computer. The messaged are intended to help VECTRONIC with debugging.

Collar Status: Could not re-establish serial-USB route!

To monitor the collar status via the USB interface, it is necessary to configure the Link Manager to route the data through. This connection has to be automatically re-established, if no data is received within approx. 20 seconds. Close and reopen the status form.

Collar Status: Could not set Serial-USB route!

To monitor the collar status via the USB interface, it is necessary to configure the Link Manager to route the data through. This configuration failed.

Collar Status: Link manager could not be reset.

To monitor the collar status via the USB interface, it is necessary to configure the Link Manager to route the data through. The configuration has to be disabled again by resetting the Link Manager. This has failed.

Collar Update Firmware: Firmware Data could not be sent! Page [page number]. Do you want to retry sending the data?

The data could not be sent to the device. You have the choice to cancel the whole process or to try writing the block again and continue.

Collar Update Firmware: Firmware Data could not be validated! Page [page number]. Do you want to retry sending the data?

The data send to the device could not be verified. You have the choice to cancel the whole process or try to read the block again and continue.

Collar Update Firmware: Firmware Data is invalid! Page [page number]. Do you want to retry sending the data?

The data send to the device has been verified and found to be not correct. You have the choice to cancel the whole process or try to write and verify the block again and continue.

Collar Update Firmware: The Line No. [line number] could not be interpreted: [line content]

A line in the selected file is not interpretable by the program. Please use another file.

Collar Update Firmware: Updating the firmware was NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

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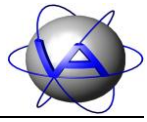

Configure Destination Address: Collar phone number is not valid! Please enter a valid phone number.

The phone number of the destination collar field contained characters not allowed as input.

Configure Destination Address: Collar phone number is not valid! Please enter a phone number.

The phone number of the destination collar field seems to be empty. Enter a destination address.

Configure Destination Address: Destination Address is not valid! Please use only numbers and no letters or other characters (such as "+", " ").

The destination address contained characters not allowed as input.

Configure Destination Address: Destination Address is not valid! Please enter an Address.

The destination address field seems to be empty. Enter a destination address.

Configure Destination Address: The GSM mode of the destination collar is not given! The SMS will not be sent.

The destination address can only be set via GSM if the collar has been received on this base station already.

Configure Service Centre Address: Collar phone number is not valid! Please enter a valid phone number.

The phone number of the destination collar field contained characters not allowed as input.

Configure Service Centre Address: Collar phone number is not valid! Please enter a phone number.

The phone number of the destination collar field seems to be empty. Enter a destination address.

Configure Service Centre Address: Service Centre Address is not valid! Please use only numbers and no letters or other characters (such as "+", " ").

The service centre address contained characters not allowed as input.

Configure Service Centre Address: Service Centre Address is not valid! Please enter an Address.

The service centre address field seems to be empty. Enter a destination address.

Configure Service Centre Address: The GSM mode of the destination collar is not given! The SMS will not be sent.

The service centre address can only be set via GSM if the collar has been received on this base station already.

Convert Firmware: Reading File NOT successful! Unidentified Character: "[character]"

The selected file contained a character that should not be in this file! Either the file is corrupted or you have selected a wrong file.

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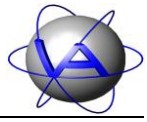

Data Reception: email reception is not configured completely! Please set the POP3 host, user name, and password in the Incoming Mail Server box of the options form. (File - Options - Mail Server)

To use the email reception, you have to configure the POP3 host settings. Otherwise the program does not know where to get the email from.

Data Reception: The Collar No. [collar id] should use GSM mode 4-6 (6-bit) but the received data is not 6-bit data! The message may be GSM mode 1-3 (7-bit) data, so it is stored as 7-bit anyway with the following name: [file name]. This file may contain invalid data. Be careful when using this data. Please check your collar GSM mode entry.

There are several modes of transmission available for GSM collars. The program identified the collar to use a mode that does not match with the mode assigned to the collar within the program. The result may be a SMS file containing invalid position data. The program cannot distinguish between position data, which makes sense and which doesn't. Please check your GSM mode configuration of your collars.

Drag & Drop GPS Data File: Incorrect input file extension! File [file name] File has not been read.

A file dropped on the position chart form has not the correct file extension. Nothing happened, but the file has not been read, too.

Drag & Drop GPS Data File: Incorrect input file format! File [file name] File has not been read.

A file dropped on the position chart form has not the correct file format. Nothing happened, but the file has not been read, too.

Erasing Flash: Command NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

Erasing Flash: Timeout: No Data from Collar!

For every erased page the collar transmits the page number. The program has not received the expected data within its time limit.

Export Activity Data: No data available for export.

You first need to load a file before exporting it.

Get Terminal Activity Data: Failed to read data! Do you want to retry reading this data or cancel transmission overall?

The transfer of data from the terminal to the computer failed. You may retry to read the data or cancel the whole operation.

Get Terminal Fix Data: Failed to read data! Do you want to retry reading this data or cancel transmission overall?

The transfer of data from the terminal to the computer failed. You may retry to read the data or cancel the whole operation.

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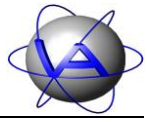

Get Terminal Mortality Data: Failed to read data! Do you want to retry reading this data or cancel transmission overall?

The transfer of data from the terminal to the computer failed. You may retry to read the data or cancel the whole operation.

GPS Data File Upload: Failed to upload data! Collar ID was not valid.

The ID stored in the file is not valid. Either this file is not a regular collar file or it is corrupted.

GPS Data File Upload: Failed to upload data! Data in destination Slot may be inconsistent. Please try again or erase slot.

The upload of position data to a terminal memory slot failed. The data may be partly written and therefore it may be inconsistent. It is strongly recommended to erase the slot or to write the data again to the same slot.

GPS Data File Upload: Failed to upload data! Destination slot contains differential data, while selected file contains solved data. Please erase slot and select collar ID for it again.

The program cancelled the upload of position data to a terminal memory slot because the configuration of the slot did not match that of the data.

GPS Data File Upload: Failed to upload data! Destination slot contains solved data, while selected file contains differential data. Please erase slot and select collar ID for it again.

The program cancelled the upload of position data to a terminal memory slot because the configuration of the slot did not match that of the data.

GPS Data File Upload: Failed to verify data! Do you want to retry reading this data or cancel transmission overall?

The data received from the terminal is not the same as the data previously written. You may retry to read the data or cancel the whole operation.

GPS Data: Could not set serial-USB route!

To monitor the collar GPS output via the USB interface, it is necessary to configure the Link Manager to route the data through. This connection has to be automatically re-established if no data is received within approx. 20 seconds. Close and reopen the status form.

GPS Plus Options: Collar ID is not a number in the range of 1…65535!

You entered a value in the Collar ID combo box that is not valid. Only values between 1 and 65535 are allowed, no other characters.

GPS Plus: The configured SMS Text Directory does not exist: [directory]. It will be set to the default value: [Program directory]\SMS

The INI-file of the program contained a directory name as SMS text directory that does not exist on the computer. The value has been set to the default directory.

GPS Request: Command NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

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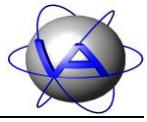

GSM Interface: Could not evaluate +CPIN result! [error string]

The Command for setting the GSM PIN did not work. [error string] contains more information.

GSM Interface: Could not evaluate CMGR result!

The result of the CMGR command (Read SMS message) could not be evaluated.

GSM Interface: Could not evaluate CPMS result!

The result of the CPMS command (Read SMS message memory capacity) could not be evaluated.

GSM Interface: Echo not complete from GSM Base Station!' "[outgoing string]" "[echoed string]"

The echoed string was not complete. It had fewer characters than the sent string.

GSM Interface: Error from GSM Base Station: [error string]

General error (depending on command) returned from GSM modem.

GSM Interface: Error from GSM Base Station: +CME ERROR: [error string]

The CME command returned an error code.

GSM Interface: Failed to set PIN! PIN might be incorrect.

The program failed to set the "personal identification number" (PIN) of the GSM station.

GSM Interface: No or wrong Echo from GSM Base Station! "[outgoing string]" "[echoed string]"

The string echoed had the right length but differed from the sent string or it was not complete (less characters than the sent string).

GSM Interface: No serial port open! Please select a valid one.

You have not yet selected a Com Port for the given device which can be used by the GPS Plus. Choose one via the Com Port menu.

GSM Interface: No SIM card inserted! Please insert SIM and set PIN.

The GSM modem has no SIM-card inserted. Please insert a SIM-card and make sure the PIN configured in the *Options* form is correct. Then try again.

GSM Interface: PIN Error [error string]

This error message returns the error received from the GSM modem while setting the PIN.

GSM Interface: PIN number is not correct! Please correct PIN number and try again.

The PIN you entered in the Options form is not correct! May be you changed the SIM-card of your base station?

GSM Interface: Send SMS Message Command was not acknowledged!

The program tried to send a SMS but the response of the GSM modem was not what has been expected. The SMS was probably not send.

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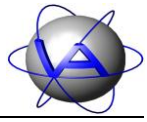

GSM Interface: Setting PIN command could not be send correctly! Maybe GSM modem is not connected.

This is a follow-up error message of a more detailed message. It just reminds you that the command failed.

GSM Interface: Unknown data rate for GSM interface! Data rate will be set to 9600 bps.

The INI-file of the program contained an unknown value for the data rate of the GSM modem. The data rate will be configured to the default of 9600 BAUD. To change it select GSM mode and then select the data rate via the COM menu.

GSM Interface: Unknown interface ID!

You will probably never encounter this error. The message is intended to help VECTRONIC with debugging.

GSM Interface: Unknown Phone Activity Status answer! "[answer string]"

Maybe your GSM modem does not support this feature or is not compatible in this regard with GPS Plus. This error will have no influence on the normal operation of GPS Plus. Only the GSM Status command is affected.

GSM Interface: Writing to serial port failed!

The program tried to send a string to the GSM modem and failed. This should never occur. Please contact customer service.

GSM Interface: Wrong echo from GSM Base Station! "[outgoing string]" "[echoed string]"

The string echoed had the right length but differed from the sent string.

GSM Interface:
Could not close serial interface!
or **Could not open Serial Port!**
or **Could not set buffer size!**
or **Could not set communication settings!**
or **Could not set flow control settings!**
or **Could not set timeout parameters!**
or **Could not open Serial Port!**

These are all errors resulting from initialising the communication interface of the GSM modem. The program was not able to open the serial port. This can be due to several reasons: The port you tried is already in use or the port does not exist on your computer. The messages are intended to help VECTRONIC with debugging.

Key validation Error: Key for this collar is not registered! Please register collar no [collar ID] via menu: File-Register Collar

The program has no key for the connected collar. Please register the collar via Collar List (chapter 3.1.6). If you do not have this key please contact us to obtain a key for your collar.

Link Manager Telemetry: Command not possible in Terminal mode using USB interface. This is only possible with serial interface.

Link Manager Telemetry can only be done when being in collar mode or not being connected via USB in terminal mode.

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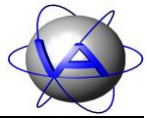

Mail Server Options: The value given as SMTP Port is not valid! Please enter the port number your SMTP server is using or leave this field open to use the default SMTP port.

Only numbers are allowed as input in this field. The default (25) is assumed if no character is entered.

Manage Terminal Data: Failed to read data from Terminal! Maybe Terminal was not switched on or not connected.

The program did not get any data from the terminal. Maybe you selected the wrong communication port, the terminal was switched of, or it was not connected

Manage Terminal Data: Failed to read data! Do you want to retry reading this data or cancel transmission overall?

The data transfer of data from the terminal to the Computer failed. You may retry to read the data or cancel the whole operation.

Manage Terminal Data: Failed to send data! Do you want to retry sending this data or cancel the transmission?

The program tried to send data to the terminal and failed. Maybe your computer is too busy and lost one or more bytes of the transmission. If you have other applications running which may take time for the computer to process please close them and try again.

Memory Bank Backup: Failed to read data! Do you want to retry reading this data or cancel transmission overall?

The data transfer of data from the terminal to the Computer failed. You may retry to read the data or cancel the whole operation.

Memory Bank Restore: Failed to read data! Do you want to retry reading this data or cancel transmission overall?

The data transfer of data from the terminal to the Computer for verification failed. You may retry to read the data or cancel the whole operation.

Memory Bank Restore: Failed to send data! Do you want to retry reading this data or cancel transmission overall?

The data transfer of data from the Computer to the terminal failed. You may retry to write the data or cancel the whole operation.

Options - Geo Transformation: Not a valid input! Input has to be a floating-point value.

You entered a value that is not valid. Only floating point values are allowed as input.

Read Complete EEPROM: User Interrupt!

The user has cancelled the reading of the EERPROM.

Read Complete EEPROM: User Interrupt!

This indicates that the user cancelled the command.

Read Complete Flash: User Interrupt!

This indicates that the user cancelled the command.

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Read Complete Flash: User Interrupt!
Test GPS: Command NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

Reading Flash Page: Command NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

Reading GPS Data: Unknown GPS Mode!

The GPS mode in the collar is not valid. The collar has to be reconfigured (cannot be corrected by the user). Please contact customer service.

Register GSM Collar ID: ID has to be between 1 and 65535! Please select a valid one.

You have tried to associate a Collar ID to a phone number, which is not in the allowed range from 1 to 65535. Set it to the ID of the collar that is using the given phone number.

Restore Collar Configuration: User Interrupt!

This indicates that the user cancelled the command.

Send Schedule: Data in Collar is not correct! Do you want to retry sending this block or cancel transmission overall?

The data send to the collar has been verified and found to be not correct. You have the choice to cancel the whole process or try to read the block again and continue.

Send Schedule: Data in Terminal is not correct! Do you want to retry sending this block or cancel transmission overall?

The data send to the terminal has been verified and found to be not correct. You have the choice to cancel the whole process or try to read the block again and continue.

Send Schedule: Failed to receive a data block for verification! Do you want to retry receiving this block or cancel transmission overall?

There was an error receiving the data for verification that has just been sent. You have the choice to cancel the whole process or try to read the block again and continue.

Send Schedule: Failed to send a data block! Do you want to retry sending this block or cancel transmission overall?

There was an error sending one of the data blocks. You have the choice to cancel the whole process or try to send the block again and continue.

Send Schedule: Schedule activation failed! Please try to send the data again.

The schedule data has been successfully sent but has not been activated. The schedule will not have an effect if it is not activated!

Send Schedule: Schedule Rules are invalid! A Start Time or Date is later than an End Time or Date. File: [rules file name]

In the rules file there is a start time of a rule that is later than the end time of this rule. Maybe you edited the rules file manually.

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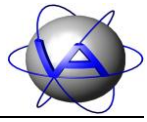

Send Schedule: Schedule Rules are invalid! A Time or Date is probably not valid. File: [rules file name]

A time or date is has not the right format and could not be interpreted. Maybe you edited the rules file manually.

Send Schedule: Schedule Rules are invalid! There are too many rules or the rules are too long. File: [rules file name]

You have defined more rules than the device can handle. Reduce the rules or try to send schedule as list based schedule.

Send Schedule: Schedule Rules are invalid! This beacon schedule contains a discrete Rule. File: [rules file name]

Beacon files are only allowed to contain cyclic rules. Maybe you edited the rules file manually.

Send Schedule: Schedule was NOT programmed!

This is a follow up of a more detailed error message to remind you that the whole process has failed.

Send Schedule: Sending Schedule was successful, but Collar Reset failed!

The schedule data has been successfully sent and activated but the collar has not been reset. The schedule will only be used after a reset or a fix (either manually or from an old schedule)! Do a manual collar reset from the commands menu.

Send Schedule: Sorry, could not evaluate your GPS schedule status! GPS schedule upload will be terminated.

Your collar is configured to not allow you to change the GPS schedule by yourself.

Send Schedule: Sorry, could not evaluate your UTC correction term! GPS schedule upload will be terminated.

The UTC correction term of the collar could not be determined. This is probably only a transmission error. Please try again.

Send Schedule: This Collar has no GSM mode selected! The schedule cannot be sent.

If you never received an SMS message from the selected collar, you are not able to send a schedule via SMS to the collar. The GSM mode is determined when you receive a message of the collar for the first time.

Send Schedule: Too many rules in rules file! This file cannot be sent.

You have defined more rules than the device can handle. Reduce the rules or, if sending directly to a collar, try to send the schedule as list based schedule.

Store Collar Configuration: User Interrupt!

This indicates that the user cancelled the command.

Store Terminal Configuration: User Interrupt!

The user interrupted the storing of the terminal configuration.

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Terminal Firmware Update: Command not possible in Terminal mode using USB interface. This is only possible with serial interface.

A firmware update of the terminal can only be done via the Link Manager serial interface. Please connect the terminal to the Link Manager's collar port and choose the appropriate serial port as Com Port of the program.

Terminal Firmware Update: Could not check Chip Signature of terminal! Maybe no terminal is connected.

The program tried to read type information from the collar but failed.

Terminal Firmware Update: Firmware File CRC is not correct! [expected CRC] <> [computed CRC]

The selected file seems to be corrupted. Please use another file.

Terminal Interface: Could not connect to Handheld Terminal!
Invalid Handle.
or **Device Not Found.**
or **Device Not Opened.**
or **General IO Error.**
or **Insufficient Resources.**
or **Invalid Parameter.**

These errors may occur while opening an USB port. The messages are intended to help VECTRONIC with debugging.

Terminal Interface: CRC was not correct.
Read EEPROM Byte was not successful!
or **Read Firmware Page was not successful!**
or **Read Flash Page Block was not successful!**
or **Read Flash Page was not successful!**
or **Transfer was not successful!**

The data received by the program was inconsistent. This is mostly due to a transmission error on the serial line. Please try again.

Terminal Interface: No contact within timeout! Maybe no Terminal is connected.

This is a general error. It occurs if the terminal does not send a byte within timeout. The most probable cause is that the terminal was switched off.

Terminal Interface: No port open! Please select a valid one.

You have not yet selected a Com Port for the given device that can be used by GPS Plus. Choose one via the Com Port menu.

Terminal Interface: Not all data was received within time.
Read EEPROM Byte was not successful!
or **Read Flash Page Block was not successful!**
or **Read Flash Page was not successful!**
or **Read Firmware Page was not successful!**

The program expected to receive more data from the terminal. Maybe your computer is too busy and lost one or more bytes of the transmission. If you have other applications running which may take time for the computer to process please close them and try again.

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Terminal Interface: Not all data was sent.
Write Firmware Page was not successful!
or **Write EEPROM Byte was not successful!**
or **Write Flash Page was not successful!**

The terminal did not answer within time. May be there is no device connected.

Terminal Interface: Not all telemetry data was received within time. Transfer was not successful!

The program expected to receive more data from the terminal. Maybe your computer is too busy and lost one or more bytes of the transmission. If you have other applications running which may take time for the computer to process please close them and try again.

Terminal Interface: The program has not been able to send the complete data-block of the command.

The terminal did not answer within time. May be there is no device connected.

Terminal Interface: Timeout: No Echo from Terminal!

The terminal did not answer within time. May be there is no device connected.

Terminal Interface: Unknown interface ID!

You probably will never encounter this error. The message is intended to help VECTRONIC with debugging.

Terminal Interface: USB Communication Failed! Could not send Command.

The program failed to send a command to the terminal via the USB.

Terminal Interface: Wrong Echo from Terminal! [expected value] <> [received value]

The sent character was expected to be echoed, but the echo differed from it.

Terminal Interface:
Could not close serial interface!
or **Could not set buffer size!**
or **Could not set communication settings!**
or **Could not set flow control settings!**
or **Could not set timeout parameters!**
or **Could not use this Serial Port!**
or **Unknown interface ID!**

These are all errors resulting from initialising the communication interface of the terminal. The messages are intended to help VECTRONIC with debugging.

Terminal Update Firmware: Firmware Data could not be sent! Page [page number]. Do you want to retry sending the data?

The data could not be sent to the device. You have the choice to cancel the whole process or to try writing the block again and continue.

Terminal Update Firmware: Firmware Data could not be validated! Page [page number]. Do you want to retry sending the data?

The data send to the device could not be verified. You have the choice to cancel the whole process or try to read the block again and continue.

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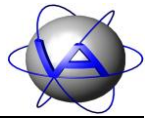

Terminal Update Firmware: Firmware Data is invalid! Page [page number]. Do you want to retry sending the data?

The data send to the device has been verified and found to be not correct. You have the choice to cancel the whole process or try to write and verify the block again and continue.

Terminal Update Firmware: Updating the firmware was NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

Test GPS: Command NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

Test Transformation: [input value] is not a valid number! Please enter a valid number.

You entered a value that is not valid. Only floating point values are allowed as input.

Test Writing Flash: Command NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

Test-Reading Flash: Command NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

Test-Reading Flash: Timeout: No Data from Collar!

The collar did not answer within time. May be there is no device connected.

Test-Writing Flash: Command NOT successful!

This is a follow up of a more detailed error message to remind you that the whole command failed.

Test-Writing Flash: Timeout: No Data from Collar!

For every written page the collar transmits the page number. The program has not received the expected data within its time limit.

Update Firmware: The Line No. [line number] could not be interpreted: [line content]

A line in the selected file is not interpretable by the program. Please use another file.

Upgrade Collar: Activation of collar option failed!

This is a general error after more detailed error message.

Upgrade Collar: The collar for this file is not registered on your computer.

You can only upgrade collars that are registered on your computer.

Upgrade Collar: The collar key in this file is not correct.

Please contact customer service.

Upgrade Collar: The ID of the connected collar is not the same as the ID given by the file.

The upgrade file is not for this collar. ID of collar and file must be the same.

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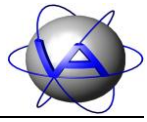

Upgrade Collar: The option code was not recognized.

Please contact customer service.

Upgrade Collar: The option failed to be written into the collar

Communication between PC and collar did not work correctly.

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Appendix B: Collar Telemetry Data Description

The following table gives an overview of the meaning of the data visible in the telemetry window:

All Tabs:

Real Time Clock:

Time	Time of the internal collar clock
Date	Date of the internal collar clock
UTC Correction	Collar internal UTC correction

System Tab:

Device

Device is	If magnet is placed correctly, device is inactive. If it is not, the device is active
Temperature [°C]	Temperature of the collar in degree Celsius

Counter

Resets	Number of resets of the collar (for diagnostics only)
Restarts	If this value is greater than 324000, collar will made a re-initialisation

Beacon Controller

Software Version	Version of the collar's beacon controller software
Update Status	Update status of the collar's beacon controller software

Software

Serial Number	Serial number of the collar
Version	Software Version
Date	Software built date

Hardware

Production Number	Production number of the collar
Version	Hardware Version
Date	Production date

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Batteries

Main	Voltage of the main battery
Backup	Voltage of the backup battery
Balancing	Internal voltage balancing process

Collected Data Tab:

GPS

On Time	Max. GPS On Time for a fix
Trial	Number of successive, not successful, GPS fixes. If this value is greater 19, a new initialisation of the GPS receiver will be performed during next fix
Valid Count	Number of validated fixes from last fix (only for diagnostics)
Avg. Fix [s]	Average time that was needed to get a fix. Computed from accumulated fix times and number of stored fixes (see Memory – GPS).

Next Measurement

Time	Time of next GPS fix
Date	Date of next GPS fix

Last Valid Fix

Time	Time of last valid fix
Date	Date of last valid fix
Lat [°]	Latitude in degree of last valid fix
Long [°]	Longitude in degree of last valid fix
Altitude [m]	Altitude in meters of last valid fix

Memory

Activity	Number of activity datasets in memory
GPS	Number of GPS datasets in memory

Activity

Activity 1	Last determined value of activity 1
Activity 2	Last determined value of activity 2
Counter	Counter to save activity value, eight second steps

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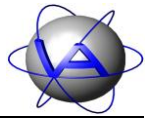

Hibernation

Hibernation active	If checked the hibernation sensor is enabled
Wakeup Level	If the activity counter reaches this level, hibernation mode will be stopped and normal operation of the collar resumed
Delay Time [h]	If no activity above the wakeup level has been detected within this time, the collar will go into hibernation mode

Mortality

Period	User programmable Mortality Period in hours
Counter	Mortality counter; counts the time since last activity has been detected and will be deleted after a Mortality Event. The timer counts in intervals of 8 seconds.

Temperature

T [°C]	Temperature of the collar in degrees Celsius

RF Tab:

VHF Beacon Schedule

Start Date	Day on which the VHF beacon will be activated
End Date	Day on which the VHF beacon will be activated
Start Time	Time at which the VHF beacon will be activated every day
End Time	Time at which the VHF beacon will be deactivated every day

RF Comm. Time

Enable	Daily start time (UTC or LMT, depending on UTC correction) of the UHF or VHF Data Communication
Disable	Daily end time (UTC or LMT, depending on UTC correction) of the UHF or VHF Data Communication

RF Modem

High Power	Gain voltage of the power amplifier, if main battery is used

Frequencies [MHz]

Uplink	Frequency in MHz from Handheld Terminal to collar
Downlink	Frequency in MHz from collar to Handheld Terminal
VHF Beacon	Frequency in MHz of the VHF beacon (only information, defined by hardware)

GSM / SatComm Tab:

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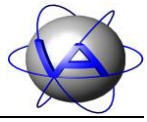

GSM

Mode	Transmission Mode: 0 - No External Communication Module 1 - 7 fixes per SMS (7-bit), no repetition / (6-bit, retry) 2 - 7 fixes per SMS (7-bit), repetition (10x) / (6-bit, retry) 3 - 1 fix per SMS (7-bit) / (6-bit, retry) 4 - 6 fixes per SMS (6-bit), no repetition / 8 fixes per SMS (8-bit, retry) 5 - 6 fixes per SMS (6-bit), repetition (10x) 6 - 1 fix per SMS (6-bit, retry) 7 - 5 fixes per SMS + header (6-bit), repetition (10x) 8 - 4 fixes per SMS + header (6-bit), repetition (10x) 9 - 3 fixes per SMS + header (6-bit), repetition (10x) 10 - 2 fixes per SMS + header (6-bit), repetition (10x) 11 - 1 fix per SMS + header (6-bit), repetition (10x)
Destination Address	Phone Number to which the SMS will be transmitted
Pin	Pin Number of GSM SIM card
SMS Count	Number of data blocks waiting for SMS delivery; if value is equal or greater than the number of positions per SMS, a SMS will be generated and transmitted

Iridium

Mode	Transmission Mode: 0 - No Iridium Module 1 - Iridium: 1 Fix per Message 2 - Iridium: 2 Fixes per Message 3 - Iridium: 3 Fixes per Message … … … 17 - Iridium: 17 Fixes per Message 18 - Iridium: 18 Fixes per Message
IMEI	Iridium device Identifier

Globalstar

Attempts	Number of consecutive transmission attempts for a data block

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Fixes per Message	Number of positions per message: 1 or 2
Tx	Transmission Mode: 0 - send every fix' 1 - send every 2nd fix 2 - send every 3rd fix 3 - send every 4th fix … … … 10 - send every 11th fix 11 - send every 12th fix 12 - send every 16th fix 13 - send every 24th fix 14 - send every 48th fix 15 - send every 96th fix
ESN	Globalstar ESN, serial number of the transmitter

Comm Interval Data

Position Transmission	Running number of position that is transmitted, the remaining positions will be stored on the collar only.

Argos Tab:

Transmitter

Mode	Mode the Argos transmitter uses (GPS or Data)
Channel	Argos Channel used
Argos ID (Hex)	Argos transmitter ID as 7-digit Hex value

RF

Timer Phi/2	Frequency configuration value
Timer +Phi	Frequency configuration value
Timer –Phi	Frequency configuration value

Control

Repetition Rate	Rate, in which the transmitter sends its messages
Number of Blocks	Number of data blocks transmitted in one message

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GPS Triplet Buffer Size	Number of GPS data messages held in memory for transmission, each containing three positions

Argos Schedule

Start Date	Beginning of the next transmission, date
Start Time	Beginning of the next transmission, time
End Date	End of the next transmission, date
End Time	End of the next transmission, time
Next Transmission in	Time until next transmission is due

Electric

DAC Power	Digital value controlling the amplifiers output power
Pre-Heating	Warm up time before transmission actually starts

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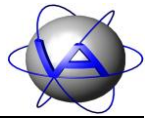

Appendix C: Files and Extensions

Files

`GPS_Plus.ini`	File with information about ports, collars and several default settings, created by GPS Plus
`MailingList.ini`	Contains email addresses of recipients of the registered collars (if any).
`MailReception_Access.Key`	Contains the key to activate the mail reception functionality.
`GeoDLL_Access.Key`	Contains the key to activate the geographical transformation functionality.
`GSM_MortalityEventsxxxxxYYMMDDHHMMSS.txt`	Contains all mortality events received via GSM from on collar (xxxxx = collar ID followed by time of storage)
`TerminalGPSSchedules.txt`	Contains a list of all GPS schedules from the Handheld Terminal.
`TerminalProximitySchedules.txt`	Contains a list of all Proximity GPS schedules from the Handheld Terminal
`TerminalGSMSchedules.txt`	Contains a list of all GSM schedules from the Handheld Terminal.
`TerminalVHFSchedules.txt`	Contains a list of all UHF beacon schedules from the Handheld Terminal.

Directories

`GPS Data`	Contains the stored GPS data files and exported GPS data files.
`Activity Data`	Contains the stored activity data files and exported activity data files.
`Mortality Files`	Contains the stored mortality data files.
`Schedule Files`	Contains schedule files for GPS and beacon.
`SMS`	Contains files of stored GSM messages.

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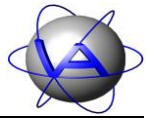

SMS\Inbox	Contains files received as GSM messages, but could not be identified as Position messages.
SMS\Outbox	Contains files to be sent as GSM messages.
Keys	Contains key files and collar upgrade files of collars.
FTDI	contains driver files for Link Manager and Handheld Terminals

List of file extensions used

.ADF	Activity Data File: Coded activity data from collar or handheld including activity and temperature. The file name consists of the collar number and the time stamp of the SMS coded as “yymmddhhmmss”.
.BRF	Beacon Rules File: Rules for both VHF beacon schedule.
.CCF	Collar Configuration File: Contains the configuration (schedules, communication configuration, activity mode) for the collar.
.COL	Collar Firmware File: Contains firmware for collars.
.GDF	GPS Data File: Binary coded GPS fix data from collar, handheld or GSM ground station including main battery voltage, VHF beacon battery voltage, and temperature.The file name consists of the collar number and the time stamp of the SMS coded as “yymmddhhmmss”.
.GRF	GPS Rules File: Rules for GPS schedule.
.KEY	Collar Key File: Contains a key for one collar, needed to register a collar in the GPS PLUS Collar Manager and manage its data.
.PRX	Proximity Sensor Data: Contains data from proximity sensor including signal strength and time stamp.
.SMS	GSM Message File: Contains one GSM or part of a Globalstar/Iridium message with GPS data. The file name consists of the collar number and the time stamp of the SMS coded as “yymmddhhmmss”.
.TCF	Handheld Terminal Configuration File: Contains the configuration of the Handheld Terminal.
.TRM	Handheld Terminal Firmware File: Contains firmware for Handheld Terminal.
.VCF	Virtual Fence Collection: Coordinates for Virtual Fences
.!PS	PDU SMS file that could not be sent

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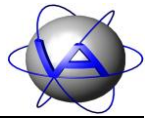

`.!TS` Text SMS file that could not be sent

`.~PS` PDU SMS file that was successfully sent

`.~TS` Text SMS file that was successfully sent

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Appendix D: Time zones

This list is not exhaustive. There are too many time zones to show a complete list. So it will list only common international time zones.

Abbreviation	Time zone	LMT - UTC
ADT	Atlantic Daylight Time	-3
AHST	Alaska-Hawaii Standard Time	-10
AKDT	Alaska Standard Daylight Saving Time	-9
AKST	Alaska Standard Time	-10
AST	Atlantic Standard Time	-4
AT	Azores Time	-2
BST	British Summer Time	+1
BT	Baghdad Time	+3
CAT	Central Alaska Time	-10
CCT	China Coast Time	+8
CDT	Central Daylight Time (USA)	-5
CEST	Central European Summer Time	+2
CET	Central European Time	+1
CST	Central Standard Time (USA)	-6
EADT	East Australian Daylight Time	+11
EAST	East Australian Standard Time	+10
EDT	Eastern Daylight Time (USA)	-4
EEST	Eastern European Summer Time	+3
EET	Eastern European Time	+2
EST	Eastern Standard Time	-5
FST	French Summer Time	+2
FWT	French Winter Time	+1
GMT	Greenwich Mean Time	0
HST	Hawaii Standard Time	-10
IDLE	International Date Line East	+12
IDLW	International Date Line West	-12
IST	Irish Summer Time	+1
JST	Japan Standard Time	+9
MDT	Mountain Daylight Time (USA)	-6
MEST	Middle European Summer Time	+2
MESZ	Middle European Summer Time	+2
MET	Middle European Time	+1
MEWT	Middle European Winter Time	+1
MEZ	Middle European Time	+1
MSD	Moscow Summer Time	+4
MSK	Moscow Time	+3
MST	Mountain Standard Time (USA)	-7
MT	Mountain Time (USA)	-7
NZST	New Zealand Standard Time	+12
PDT	Pacific Daylight Time (USA)	-7
PST	Pacific Standard Time (USA)	-8
PT	Pacific Time (USA)	-8
SST	Swedish Summer Time	+2
SWT	Swedish Winter Time	+1
TAI	Time Atomic International	0
UT	Universal Time	0
UTC	Universal Time Coordinated	0
WADT	West Australian Daylight Time	+8
WAST	West Australian Time	+7
WEST	Western Europe Summer Time	+1
WET	Western European Time	0
YDT	Yukon Daylight Time	-7
YST	Yukon Standard Time	-8
Z	Zulu time - Zero-Meridian-Time	0

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Appendix E: Available Coordinate Systems

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
ASIAN International		
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
UTMref (MGRS) coordinates	zzsxyeeeeennnnn	
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
GEOREF-Code (Aircraft Navigation)	aaaannnnnnnn	
QTH-Code (Maidenhead)	aannaa	
Bangladesh (BD)		
BTM Bangladesh Transversal Mercator coordinates	kkkkmmm	kkkkmmm
India zone IIb (Bangladesh) Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Japan (JP)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Japan Plane Rectangular CS I Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS II Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS III Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS IV Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS V Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS VI Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS VII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS VIII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS IX Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS X Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XI Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XIII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XIV Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XV Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XVI Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XVII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XVIII Mercator coordinates	±kkkmmm	±kkkmmm
Japan Plane Rectangular CS XIX Mercator coordinates	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
AUSTRALIAN International		
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
UTMref (MGRS) coordinates	zzsxyeeeeennnnn	
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
GEOREF-Code (Aircraft Navigation)	aaaannnnnnnn	
QTH-Code (Maidenhead)	aannaa	
AUSTRALIAN Multinational		
Australian Lambert Conformal Conic coordinates	±kkkkmmm	±kkkkmmm
Australian VICGRID94 Lambert Conformal Conic	kkkkmmm	kkkkmmm
Australian VICGRID66 Lambert Conformal Conic	kkkkmmm	kkkkmmm
Australian Capital Territory (AU-ACT)		
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Australian Northern Territory (AU-NT)		
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Australian New South Wales (AU-NSW)		
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Australian Tasmania (AU-TAS)		
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
EUROPEAN International		
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
UTMref (MGRS) coordinates	zzsxyeeeeennnnn	
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm

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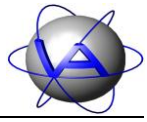

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
GEOREF-Code (Aircraft Navigation)	aaaannnnnnnn	
QTH-Code (Maidenhead)	aannaa	
EUROPEAN Multinational		
Pan-European Lambert Conformal Conic ETRS-LCC	kkkkmmm	kkkkmmm
Pan-European Lambert Azim. Equal Area ETRS-LAEA	kkkkmmm	kkkkmmm
Baltic Transversal Mercator Coord. TM Baltic93	kkkkmmm	kkkkmmm
Austria (AT)		
Austrian west zone (BMN) M28	kkkmmm	kkkmmm
Austrian central zone (BMN) M31	kkkmmm	kkkmmm
Austrian east zone (BMN) M34	kkkmmm	kkkmmm
Austrian Gauss-Krueger zone M28	±kkkmmm	kkkkmmm
Austrian Gauss-Krueger zone M31	±kkkmmm	kkkkmmm
Austrian Gauss-Krueger zone M34	±kkkmmm	kkkkmmm
Austrian Lambert coordinates (old system)	kkkmmm	kkkmmm
Austrian Lambert coordinates (new system)	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Belgium (BE)		
Belgian Lambert50 coordinates	kkkmmm	kkkmmm
Belgian Lambert72 coordinates	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Cyprus (CY)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Czechia (CZ)		
Czech Krovak S-JTSK coordinates	kkkkmmm	kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Austrian central zone (BMN) M31	kkkmmm	kkkmmm
Austrian east zone (BMN) M34	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Denmark (DK)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Estonia (EE)		
Estonian Lambert Coordinates L-EST97	±kkkmmm	kkkkmmm
Baltic Transversal Mercator Coord. TM Baltic93	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Finland (FI)		
Finish Transversal Mercator Coord. KKJ zone 2	kkkkmmm	kkkkmmm
Finish Transversal Mercator Coord. KKJ zone 3	kkkkmmm	kkkkmmm
Finish Transversal Mercator Coord. KKJ zone 4	kkkkmmm	kkkkmmm
Finish Transv. Mercator Coord. VVJ Uniform zone 35	±kkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
France (FR)		
French Lambert93 coordinates	kkkkmmm	kkkkmmm
French Lambert zone II etendu	kkkkmmm	kkkkmmm
French Lambert zone I (north)	kkkkmmm	kkkkmmm
French Lambert zone II (centre)	kkkkmmm	kkkkmmm
French Lambert zone III (south)	kkkkmmm	kkkkmmm
French Lambert zone IV (Corse)	kkkkmmm	kkkkmmm
French Lambert coordinates Nord de Guerre	kkkkmmm	kkkkmmm
Geographic coordinates (Paris) [gon]	±ggg	±ggg
Geographic coordinates (Paris) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Paris) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Germany (DE)		
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
German Lambert mean coordinates	±kkkmmm	±kkkmmm
German Lambert zone west coordinates	±kkkmmm	±kkkmmm
German Lambert zone east coordinates	±kkkmmm	±kkkmmm
German Lambert Esri-ArcData coordinates	±kkkmmm	kkkkmmm
German Lambert LCC12 coordinates	±kkkmmm	kkkkmmm
Prussian Land Register Mueggelberg Berlin (18,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Mueggelberg Berlin (18+,DE)	±kkkmmm	±kkkmmm
German Soldner Munic	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm

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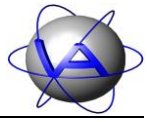

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Prussian Land Register (PK)		
Prussian Land Register Kucklinsberg (1,RU)	±kkkmmm	±kkkmmm
Prussian Land Register Paulinen (2,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Markushof (3,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Turmberg (4,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Kauernik (5,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Thorn (6,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Heinrichsthal (7,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Gollenberg (8,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Gnesen (9,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Josephsberg (10,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Schroda (11,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Pschow (12,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Rummelsberg (13,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Groeditzberg (14,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Kaltenborn (15,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Bahn (16,PL)	±kkkmmm	±kkkmmm
Prussian Land Register Greifswald (17,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Greifswald (17+,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Mueggelberg Berlin (18,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Mueggelberg Berlin (18+,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Goetzerberg (19,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Torgau (20,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Burkersroda (21,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Magdeburg (23,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Ostenfeld (24,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Rathkruegen (25,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Bungsberg (26,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Celle (27,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Kaltenborn (28,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Silberberg (29,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Windberg (30,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Hermannsdenkmal (31,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Muenster (32,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Bochum (33,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Homert (34,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Kassel (35,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Schaumburg (36,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Fleckert (37,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Koeln (38,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Langschoss (39,DE)	±kkkmmm	±kkkmmm
Prussian Land Register Rissenthal (40,DE)	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Great Britain (GB)		
British Transverse Mercator coordinates	kkkkmmm	kkkkmmm
British National Grid (BNG)	aaeeeeennnnn	
Irish National Grid (ING)	aaeeeeennnnn	
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss

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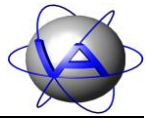

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Greece (GR)		
Greek Transversal Mercator Coordinates GGRS87	kkkkmmm	kkkkmmm
Greek UTM Coordinates zones 4-5	skkkmmm	kkkkmmm
Greek Transversal Mercator Coord. TM3 west zone	kkkmmm	kkkmmm
Greek Transversal Mercator Coord. TM3 middle zone	kkkmmm	kkkmmm
Greek Transversal Mercator Coord. TM3 east zone	kkkmmm	kkkmmm
Geographic coordinates (Athens) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Athens) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Hungary (HU)		
Hungarian EOV coordinates	kkkkmmm	kkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Ireland (IE)		
Irish Transverse Mercator coordinates	kkkkmmm	kkkkmmm
Irish National Grid (ING)	aaeeeeennnnn	
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Italy (IT)		
Italian Gauss-Boaga west zone	kkkkmmm	kkkkmmm
Italian Gauss-Boaga east zone	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Roma) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Roma) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Latvia (LV)		
Latvian Transversal Mercator Coord. LKS92	kkkmmm	kkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Baltic Transversal Mercator Coord. TM Baltic93	kkkkmmm	kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Liechtenstein (LI)		
Swiss grid coordinates (LV95)	kkkkmmm	kkkkmmm
Swiss grid coordinates (LV03)	kkkmmm	kkkmmm
Swiss grid coordinates (Old Grid)	±kkkmmm	±kkkmmm

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Lithuania (LT)		
Lithuanian Transversal Mercator Coord. LKS94	kkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Baltic Transversal Mercator Coord. TM Baltic93	kkkkmmm	kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Luxembourg (LU)		
Luxemburgian Transverse Mercator	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
Malte (MT)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Netherlands (NL)		
Netherlands Stereographic coordinates	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Norway (NO)		
Norwegian Transv. Mercator NGO1948 zone 1	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 2	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 3	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 4	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 5	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 6	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 7	±kkkkmmm	±kkkkmmm
Norwegian Transv. Mercator NGO1948 zone 8	±kkkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Poland (PL)		
Polish Gauss-Krueger 2000/15-24 (3 degree strips)	skkkmmm	kkkkmmm
Polish Gauss-Krueger coordinates 1992/19	±kkkmmm	±kkkmmm
Polish Stereographic 1965 zone 1	kkkkmmm	kkkkmmm
Polish Stereographic 1965 zone 2	kkkkmmm	kkkkmmm
Polish Stereographic 1965 zone 3	kkkkmmm	kkkkmmm

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Polish Stereographic 1965 zone 4	kkkkmmm	kkkkmmm
Polish Transverse Mercator 1965 zone 5	±kkkmmm	±kkkmmm
Polish Stereographic GUGiK coordinates	kkkkmmm	kkkkmmm
Polish Gauss-Krueger 1942/15-24 (3 degree strips)	skkkmmm	kkkkmmm
Polish Gauss-Krueger 1942/15-21 (6 degree strips)	skkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Portugal (PT)		
Portugese Transversal Mercator DLX coordinates	kkkkmmm	kkkkmmm
Portugese Transversal Mercator D73 coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Slovakia (SK)		
Slovakian Krovak S-JTSK coordinates	kkkkmmm	kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
Austrian central zone (BMN) M31	kkkmmm	kkkmmm
Austrian east zone (BMN) M34	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Slovenia (SI)		
Slovenian Transversal Mercator Coord. D48	kkkmmm	kkkkmmm
Slovenian Transversal Mercator Coord. D48+	kkkmmm	kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Spain (ES)		
Spanish Lambert MADRID coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Madrid) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Madrid) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Sweden (SE)		
Swedish Transv. Mercator RT90 7.5gonV 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 5gonV 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 2.5gonV 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 0gon 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 2.5gonO 0:-15	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT90 5gonO 0:-15	kkkkmmm	kkkkmmm

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Swedish Transv. Mercator RT R01 Skåne	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R02 Halland	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R03 Karlshamn	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R04 Göteborg	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R05 Vänern	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R06 Småland	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R07 Örebro	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R08 Gotland	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R09 Stockholm	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R10 Gävle-Dala	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R11 Umeå	kkkkmmm	kkkkmmm
Swedish Transv. Mercator RT R12 Luleå	kkkkmmm	kkkkmmm
Swedish Transversal Mercator Coord. (13° 35')	kkkkmmm	kkkkmmm
Swedish UTM Coordinates zone 33	kkkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Switzerland (CH)		
Swiss grid coordinates (LV95)	kkkkmmm	kkkkmmm
Swiss grid coordinates (LV03)	kkkmmm	kkkmmm
Swiss grid coordinates (Old Grid)	±kkkmmm	±kkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
NORTH AMERICAN International		
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Geographic coordinates (Greenwich) [gon]	±ggg	±ggg
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
UTM coordinates (southern hemisphere)	sskkkmmm	kkkkkmmm
UTMref (MGRS) coordinates	zzsxyeeeeennnnn	
Gauss-Krueger (3 degree wide strips)	ssskkkmmm	±kkkkmmm
Gauss-Krueger (6 degree wide strips)	sskkkmmm	±kkkkmmm
GEOREF-Code (Aircraft Navigation)	aaaannnnnnnn	
QTH-Code (Maidenhead)	aannaa	
NORTH AMERICAN Multinational		
US National Atlas Lambert Azimuthal Equal Area	±kkkkmmm	±kkkkmmm
Canada - Mean Territory (CA)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - British Columbia & Alberta (CA-BC+AB)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm

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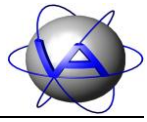

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - Maritime Provinces (CA-MPR)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
CA-MTM zone 1 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM Newfoundland zone 2 Transv. Mercator	kkkkmmm	kkkkmmm
CA-MTM zone 3 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM Nova Scotia zone 4 Transv. Mercator	kkkkmmm	kkkkmmm
CA-MTM Nova Scotia zone 5 Transv. Mercator	kkkkmmm	kkkkmmm
CA New Brunswick NAD83 Stereographic coordinates	kkkkmmm	kkkkmmm
CA New Brunswick ATS77 Stereographic coordinates	kkkkmmm	kkkkmmm
CA Prince Edward Isl. NAD83 Stereographic Koord	kkkkmmm	kkkkmmm
CA Prince Edward Isl. ATS77 Stereographic Koord.	kkkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - North West Territories (CA-NWT)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - Ontario & Manitoba (CA-ON+MN)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
CA-MTM zone 11 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 12 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 13 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 14 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 15 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 16 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 17 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - Quebec (CA-QUE)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
CA-MTM Quebec zone 2 Transversal Mercator coord.	kkkkmmm	kkkkmmm
CA-MTM zone 4 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 5 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 6 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 7 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 8 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 9 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA-MTM zone 10 Transversal Mercator coordinates	kkkkmmm	kkkkmmm
CA Quebec Lambert coordinates	±kkkkmmm	kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
Canada - Yukon (CA-YUK)		
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Alabama (US-AL)		
US-SPCS 1983 (101) Alabama east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (101) Alabama east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (102) Alabama west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (102) Alabama west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Alaska (US-AK)		
US-SPCS 1983 (5001) Alaska 1 Hotine Oblique Merc.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5001) Alaska 1 Hotine Oblique Merc.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5002) Alaska 2 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5002) Alaska 2 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5003) Alaska 3 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5003) Alaska 3 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5004) Alaska 4 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5004) Alaska 4 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5005) Alaska 5 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5005) Alaska 5 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5006) Alaska 6 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5006) Alaska 6 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5007) Alaska 7 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5007) Alaska 7 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5008) Alaska 8 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5008) Alaska 8 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5009) Alaska 9 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5009) Alaska 9 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5010) Alaska 10 Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (5010) Alaska 10 Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - American Samoa (US-AS)		
US-SPCS 1927 (5300) American Samoa Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd

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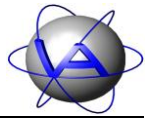

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Arizona (US-AZ)		
US-SPCS 1983 (202) Arizona central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (202) Arizona central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (201) Arizona east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (201) Arizona east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (203) Arizona west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (203) Arizona west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Arkansas (US-AR)		
US-SPCS 1983 (301) Arkansas north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (301) Arkansas north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (302) Arkansas south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (302) Arkansas south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - California (US-CA)		
US-SPCS 1983 (401) California I Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (401) California I Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (402) California II Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (402) California II Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (403) California III Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (403) California III Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (404) California IV Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (404) California IV Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (405) California V Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (405) California V Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (406) California VI Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (406) California VI Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (407) California VII Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Colorado (US-CO)		
US-SPCS 1983 (502) Colorado central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (502) Colorado central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (501) Colorado north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (501) Colorado north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (503) Colorado south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (503) Colorado south Lambert coord.	kkkkmmm	kkkkmmm

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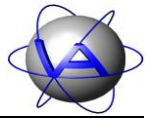

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Conneticut (US-CT)		
US-SPCS 1983 (600) Connecticut Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (600) Connecticut Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Delaware (US-DE)		
US-SPCS 1983 (700) Delaware Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (700) Delaware Transv. Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Florida (US-FL)		
US-SPCS 1983 (901) Florida east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (901) Florida east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (903) Florida north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (903) Florida north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (902) Florida west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (902) Florida west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Georgia (US-GA)		
US-SPCS 1983 (1001) Georgia east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1001) Georgia east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1002) Georgia west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1002) Georgia west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Hawaii (US-HI)		
US-SPCS 1983 (5101) Hawaii 1 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5101) Hawaii 1 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5102) Hawaii 2 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5102) Hawaii 2 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5103) Hawaii 3 Transv. Mercator coord.	kkkkmmm	kkkkmmm

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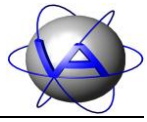

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
US-SPCS 1927 (5103) Hawaii 3 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5104) Hawaii 4 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5104) Hawaii 4 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (5105) Hawaii 5 Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (5105) Hawaii 5 Transv. Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Idaho (US-ID)		
US-SPCS 1983 (1102) Idaho central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1102) Idaho central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1101) Idaho east Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (1101) Idaho east Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1983 (1103) Idaho west Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (1103) Idaho west Transv. Mercator	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Illinois (US-IL)		
US-SPCS 1983 (1201) Illinois east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1201) Illinois east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1202) Illinois west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1202) Illinois west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Indiana (US-IN)		
US-SPCS 1983 (1301) Indiana east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1301) Indiana east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1302) Indiana west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1302) Indiana west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Iowa (US-IA)		
US-SPCS 1983 (1401) Iowa north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (1401) Iowa north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (1402) Iowa south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (1402) Iowa south Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Kansas (US-KS)		
US-SPCS 1983 (1501) Kansas north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1501) Kansas north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1502) Kansas south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1502) Kansas south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Kentucky (US-KY)		
US-SPCS 1983 (1601) Kentucky north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1601) Kentucky north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1602) Kentucky south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1602) Kentucky south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Louisiana (US-LA)		
US-SPCS 1983 (1701) Louisiana north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1701) Louisiana north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1703) Louisiana offshore Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1703) Louisiana offshore Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (1702) Louisiana south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (1702) Louisiana south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Maine (US-ME)		
US-SPCS 1983 (1801) Maine east Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (1801) Maine east Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1983 (1802) Maine west Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (1802) Maine west Transv. Mercator	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Maryland (US-MD)		
US-SPCS 1983 (1900) Maryland Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (1900) Maryland Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Massachusetts (US-MA)		
US-SPCS 1983 (2002) Massachusetts island Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (2002) Massachusetts island Lambert	kkkkmmm	kkkkmmm
US-SPCS 1983 (2001) Massachusetts mainland Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (2001) Massachusetts mainland Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Michigan (US-MI)		
US-SPCS 1983 (2112) Michigan central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2112) Michigan central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2102) Michigan central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2101) Michigan east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2111) Michigan north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2111) Michigan north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2113) Michigan south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2113) Michigan south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2103) Michigan west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Minnesota (US-MN)		
US-SPCS 1983 (2202) Minnesota central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2202) Minnesota central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2201) Minnesota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2201) Minnesota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2203) Minnesota south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2203) Minnesota south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Mississippi (US-MS)		
US-SPCS 1983 (2301) Mississippi east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2301) Mississippi east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2302) Mississippi west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2302) Mississippi west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
USA - Missouri (US-MO)		
US-SPCS 1983 (2402) Missouri central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2402) Missouri central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2401) Missouri east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2401) Missouri east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2403) Missouri west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2403) Missouri west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Montana (US-MT)		
US-SPCS 1983 (2500) Montana Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (2502) Montana central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2501) Montana north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2503) Montana south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Nebraska (US-NE)		
US-SPCS 1983 (2600) Nebraska Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (2601) Nebraska north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2602) Nebraska south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Nevada (US-NV)		
US-SPCS 1983 (2702) Nevada central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2702) Nevada central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2701) Nevada east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2701) Nevada east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (2703) Nevada west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2703) Nevada west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - New Hampshire (US-NH)		
US-SPCS 1983 (2800) New Hampshire Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (2800) New Hampshire Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - New Jersey (US-NJ)		
US-SPCS 1983 (2900) New Jersey Transv. Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (2900) New Jersey Transv. Mercator	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - New Mexico (US-NM)		
US-SPCS 1983 (3002) New Mexico central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (3002) New Mexico central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1983 (3001) New Mexico east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3001) New Mexico east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3003) New Mexico west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3003) New Mexico west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - New York (US-NY)		
US-SPCS 1983 (3102) New York central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3102) New York central Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3101) New York east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3101) New York east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3104) New York Long Island Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (3104) New York Long Island Lambert	kkkkmmm	kkkkmmm
US-SPCS 1983 (3103) New York west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3103) New York west Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - North Carolina (US-NC)		
US-SPCS 1983 (3200) North Carolina Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3200) North Carolina Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - North Dakota (US-ND)		
US-SPCS 1983 (3301) North Dakota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3301) North Dakota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3302) North Dakota south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3302) North Dakota south Lambert coord.	kkkkmmm	kkkkmmm

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Ohio (US-OH)		
US-SPCS 1983 (3401) Ohio north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (3401) Ohio north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (3402) Ohio south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (3402) Ohio south Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Oklahoma (US-OK)		
US-SPCS 1983 (3501) Oklahoma north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3501) Oklahoma north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3502) Oklahoma south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3502) Oklahoma south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Oregon (US-OR)		
US-SPCS 1983 (3601) Oregon north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3601) Oregon north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3602) Oregon south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3602) Oregon south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Pennsylvania (US-PA)		
US-SPCS 1983 (3701) Pennsylvania north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3701) Pennsylvania north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (3702) Pennsylvania south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3702) Pennsylvania south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Puerto Rico (US-PR)		
US-SPCS 1983 (5200) Puerto Rico Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (5201) Puerto Rico Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Rhode Island (US-RI)		
US-SPCS 1983 (3800) Rhode Island Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3800) Rhode Island Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - South Carolina (US-SC)		
US-SPCS 1983 (3900) South Carolina Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (3901) South Carolina north Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (3902) South Carolina south Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - South Dakota (US-SD)		
US-SPCS 1983 (4001) South Dakota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4001) South Dakota north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4002) South Dakota south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4002) South Dakota south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Tennessee (US-TN)		
US-SPCS 1983 (4100) Tennessee Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4100) Tennessee Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Texas (US-TX)		
US-SPCS 1983 (4203) Texas central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4203) Texas central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4201) Texas north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4201) Texas north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (4202) Texas north central Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (4202) Texas north central Lambert	kkkkmmm	kkkkmmm
US-SPCS 1983 (4205) Texas south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4205) Texas south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (4204) Texas south central Lambert	kkkkmmm	kkkkmmm

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Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
US-SPCS 1927 (4204) Texas south central Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Utah (US-UT)		
US-SPCS 1983 (4302) Utah central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4302) Utah central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4301) Utah north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4301) Utah north Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1983 (4303) Utah south Lambert coordinates	kkkkmmm	kkkkmmm
US-SPCS 1927 (4303) Utah south Lambert coordinates	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Vermont (US-VT)		
US-SPCS 1983 (4400) Vermont Transv. Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4400) Vermont Transv. Mercator coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Virgin Islands (US-VI)		
US-SPCS 1927 (5202) Virgin Islands / St. Croix Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Virginia (US-VA)		
US-SPCS 1983 (4501) Virginia north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4501) Virginia north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4502) Virginia south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4502) Virginia south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Washington (US-WA)		
US-SPCS 1983 (4601) Washington north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4601) Washington north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4602) Washington south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4602) Washington south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm

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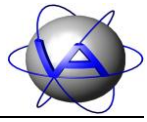

Coordinate System	Notation of 1st Ordinate	Notation of 2nd Ordinate
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - West Virginia (US-WV)		
US-SPCS 1983 (4701) West Virginia north Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (4701) West Virginia north Lambert	kkkkmmm	kkkkmmm
US-SPCS 1983 (4702) West Virginia south Lambert	kkkkmmm	kkkkmmm
US-SPCS 1927 (4702) West Virginia south Lambert	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Wisconsin (US-WI)		
US-SPCS 1983 (4802) Wisconsin central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4802) Wisconsin central Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4801) Wisconsin north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4801) Wisconsin north Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4803) Wisconsin south Lambert coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4803) Wisconsin south Lambert coord.	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
USA - Wyoming (US-WY)		
US-SPCS 1983 (4901) Wyoming east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4901) Wyoming east Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4902) Wyoming east central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (4902) Wyoming east central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1983 (4904) Wyoming west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1927 (4904) Wyoming west Mercator coord.	kkkkmmm	kkkkmmm
US-SPCS 1983 (4903) Wyoming west central Mercator	kkkkmmm	kkkkmmm
US-SPCS 1927 (4903) Wyoming west central Mercator	kkkkmmm	kkkkmmm
UTM coordinates (northern hemisphere)	sskkkmmm	±kkkkmmm
Geographic coordinates (Greenwich) [deg, min, sec]	±dddmmss	±ddmmss
Geographic coordinates (Greenwich) [deg]	±ddd	±dd
Geographic coordinates (Greenwich) [deg, min]	±dddmm	±ddmm
Geographic coordinates (Greenwich) [sec]	±ssssss	±ssssss
User Defined		
1st user defined coordinate system	(undefined)	(undefined)

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Description of notations

Geographical coordinates:

[degree]

d degree

[deg, min, sec]

d degree

m minutes

s seconds

[deg, min]

d degree

m minutes

[sec]

s seconds

[gon]

g Gon (400 Gon = 360 degree)

A negative longitude is west of Greenwich. A negative latitude is on the southern earth hemisphere.

Gauss Krueger and UTM coordinates:

s Number of the meridian strip.

With UTM coordinates (northern hemisphere), a negative northing value is on the southern earth hemisphere.

UTMref coordinates:

zzsxyeeeeennnnn

z Meridian strip (UTM zone) between 1 and 60

s Letter for a strip of the geographical latitude

x Letter for a 100 km field in east direction

y Letter for a 100 km field in north direction

e Kilometre and meter portion in east direction (Easting)

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n Kilometre and meter portion in north direction (Northing)

The number of the e and n components can vary, both components must have the same number of digits.

British and Irish national Grid:

aaeeeeennnnn

a Letters representing a 100 km square field

e Kilometre and meter portion in east direction inside a 100 km field

n Kilometre and meter portion in north direction inside a 100 km field

The number of the e and n components can vary, but both components must have the same count of digits.

GEOREF code:

aabbnnmm

a Letters for the marking of a 15 degree large net area.

b Letters for the marking of a 1 degree small range of the large net area.

n Digits for the marking of the minute portion of the geographical longitude

m Digits for the marking of the minute portion of the geographical latitude

The number of the n and m components can vary, but both components must have the same count of digits.

QTH-Code:

aannbb

a Letters for the marking of a large net area.

n Digits for the marking of a range in the large net area.

b Letters for the marking a smaller net area in that range.

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Other coordinate systems:

± Optional sign. If coordinates lie west or south of their origin point and/or of the central meridian of their coordinate system, they are provided with a minus sign.

k Kilometre component. Depending upon the coordinate system this component contains also an addition constant (e.g. UTM: 500000m).

m Meter component

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Appendix F: Available Reference Ellipsoids

- DHDN/PD (DE 1995 <±5m), Rauenberg, Bessel
- ED50 (Europe), Potsdam, Hayford/Int.
- S42/83 (East Europe), Pulkowo, Krassowskij
- ETRS89 (Europe), geocentric, GRS80
- MGI (AT/CZ), Hermannskogel, Bessel
- NTF (FR), Paris Pantheon, Clarke IGN
- RD/NAP (NL), Amersfoort, Bessel
- CH1903+ (CH/LI 1993), Zimmerwald, Bessel
- RD/83 (DE new states <±1m), Rauenberg, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- BD72 (BE), Ukkel, Hayford/Int.
- OSGB36 (GB/IE), Herstmonceux, Airy
- LUREF (LU), Habay, Hayford/Int.
- ROMA40 (IT), Monte Mario, Hayford/Int.
- GRANIT87 (CH), Zimmerwald, Bessel
- DHDN/PD (DE 2001 <±3m), Rauenberg, Bessel
- DHDN/PD (DE old states south <±1m), Rauenberg, Bessel
- DHDN/PD (DE old states middle <±1m), Rauenberg, Bessel
- DHDN/PD (DE old states north <±1m), Rauenberg, Bessel
- PD/83 (DE state TH <±1m), Rauenberg, Bessel
- S42/83 (DE states MV/LSA <±1m), Pulkowo, Krassowskij
- ED50 (FR), Potsdam, Hayford/Int.
- RGF93 (FR), geocentric, GRS80
- S-JTSK (CZ), Hermannskogel, Bessel
- CH1903 (CH/LI), Bern, Bessel
- CHTRS95 (CH/LI), geocentric, GRS80
- ROMA40 (IT-peninsular <±4m), M. Mario, Hayford/Int.
- ROMA40 (IT-Sardinia <±4m), M. Mario, Hayford/Int.
- ROMA40 (IT-Sicily <±4m), Monte Mario, Hayford/Int.
- ED50 (DK), Potsdam, Hayford/Int.
- S42/58 (PL Uklad 1965), Pulkowo, Krassowskij
- SOLDNER (DE state BY <±1m), Munic, Laplace
- BD50 (BE), Royal de Belgique, Hayford/Int.
- IRELAND65 (IE), Slieve Donard, Airy modified
- MADRID1870 (ES <±7m), Madrid, Struve
- ED50 (ES EST99 peninsular), Potsdam, Hayford/Int.
- ED50 (ES ZNW99 northwest), Potsdam, Hayford/Int.
- ED50 (ES BAL99 Balearic isl.), Potsdam, Hayford/Int.
- DLX (PT), Lisbon, Hayford/Int.
- D73 (PT), Melrica, Hayford/Int.
- ED50 (PT), Potsdam, Hayford/Int.
- HD72 (HU), Szölöhegy, GRS67
- RT90 (SE), Stockholm, Bessel
- SWEREF99 (SE), geocentric, GRS80
- NGO1948 (NO), Oslo, Bessel modified
- ED50 (NO FI), Potsdam, Hayford/Int.
- KKJ (FI), Helsinki, Hayford/Int.
- ED50 (FI), Potsdam, Hayford/Int.
- ED50 (IT Sardinia), Potsdam, Hayford/Int.

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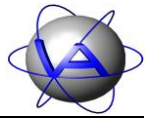

- ED50 (IT Sicily), Potsdam, Hayford/Int.
- S-JTSK (SK), Hermannskogel, Bessel
- S42/83 (PL), Pulkowo, Krassowskij
- GGRS87 (GR), Dionysos, GRS80
- ED50 (GR), Potsdam, Hayford/Int.
- D48 (SI), Hermannskogel, Bessel
- EST97 (EE), geocentric, GRS80
- S42 (EE), Pulkowo, Krassowskij
- LKS94 (LT), geocentric, GRS80
- S42 (LT), Pulkowo, Krassowskij
- LKS92 (LV), geocentric, GRS80
- S42 (LV), Pulkowo, Krassowskij
- ED50 (CY), Potsdam, Hayford/Int.
- ED50 (MT), Potsdam, Hayford/Int.
- HELLENIC (GR <±3m), Athens, Bessel
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- NAD27 (US-AK), Meade's Ranch Kansas, Clarke
- NAD27 (US-AK Aleutian east), Kansas, Clarke
- NAD27 (US-AK Aleutian west), Kansas, Clarke
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA <±15m), Kansas, Clarke
- NAD27 (CA east <±6m), Kansas, Clarke
- NAD27 (CA-NWT <±5m), Kansas, Clarke
- NAD27 (CA-BC+AB <±8m), Kansas, Clarke
- NAD27 (CA-ON+MN <±9m), Kansas, Clarke
- NAD27 (CA-YUK <±8m), Kansas, Clarke
- ATS77 (CA-MPR), geocentric, WGS72
- American Samoa 1962 (US-AS), Samoa, Clarke
- GRS80a Authalic Sphere (US+CA), Sphere, Sphere
- Old Hawaiian mean (US-HI), Oahu, Clarke
- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-ACT), Johnston, ANS
- AGD66 (AU-TAS), Johnston, ANS
- AGD66 (AU-NSW), Johnston, ANS
- AGD66 (AU-NT), Johnston, ANS
- Everest (BD), Kalianpur, Everest
- JGD2000 (JP 1994 ±1m), geocentric, GRS80
- JGD2000 (JP 2000 ±1m), geocentric, GRS80
- Tokyo (JP 1993 ±5m), Nikon, Bessel
- Tokyo (JP 1996 ±3m), Nikon, Bessel
- Tokyo (JP 1997 ±3m), Nikon, Bessel
- Tokyo (JP Okinawa), Nikon, Bessel
- Tokyo (JP Okinawa KR), Nikon, Bessel
- User defined geodetic datum shift
- No geodetic datum shift
- No datum shift and no ellipsoid transition

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Reference Systems – sorted by country/region

ASIAN International

- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Bangladesh (BD)

- Everest (BD), Kalianpur, Everest
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Japan (JP)

- JGD2000 (JP 1994 ±1m), geozentrisch, GRS80
- JGD2000 (JP 2000 ±1m), geozentrisch, GRS80
- Tokyo (JP 1993 ±5m), Nikon, Bessel
- Tokyo (JP 1996 ±3m), Nikon, Bessel
- Tokyo (JP 1997 ±3m), Nikon, Bessel
- Tokyo (JP Okinawa), Nikon, Bessel
- Tokyo (JP Okinawa KR), Nikon, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

AUSTRALIAN International

- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

AUSTRALIAN Multinational

- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Australian Capital Territory (AU-ACT)

- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-ACT), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Australian Northern Territory (AU-NT)

- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-NT), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Australian New South Wales (AU-NSW)

- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-NSW), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84

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- WGS72 (World wide), geocentric, WGS72

Australian Tasmania (AU-TAS)

- GDA94 (AU), geocentric, GRS80
- AGD84 (AU <±1m), Johnston, ANS
- AGD84 Higgins (AU <±4m), Johnston, ANS
- AGD66 (AU <±1m), Johnston, ANS
- AGD66 (AU-TAS), Johnston, ANS
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

EUROPEAN International

- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.
- S42/83 (East Europe), Pulkowo, Krassowskij

EUROPEAN Multinational

- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- ED50 (Europe), Potsdam, Hayford/Int.
- S42/83 (East Europe), Pulkowo, Krassowskij

Austria (AT)

- ETRS89 (Europe), geocentric, GRS80
- MGI (AT/CZ), Hermannskogel, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Belgium (BE)

- ETRS89 (Europe), geocentric, GRS80
- BD50 (BE), Royal de Belgique, Hayford/Int.
- BD72 (BE), Ukkel, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.
- NTF (FR), Paris Pantheon, Clarke IGN

Cyprus (CY)

- ED50 (CY), Potsdam, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84

Czechia (CZ)

- ETRS89 (Europe), geocentric, GRS80
- S-JTSK (CZ), Hermannskogel, Bessel
- S42/83 (East Europe), Pulkowo, Krassowskij
- MGI (AT/CZ), Hermannskogel, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Denmark (DK)

- ED50 (DK), Potsdam, Hayford/Int.
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

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Estonia (EE)

- EST97 (EE), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- S42 (EE), Pulkowo, Krassowskij
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84

Finland (FI)

- KKJ (FI), Helsinki, Hayford/Int.
- ED50 (FI), Potsdam, Hayford/Int.
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84

France (FR)

- RGF93 (FR), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- NTF (FR), Paris Pantheon, Clarke IGN
- ED50 (FR), Potsdam, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Germany (DE)

- ETRS89 (Europe), geocentric, GRS80
- DHDN/PD (DE 1995 <±5m), Rauenberg, Bessel
- DHDN/PD (DE 2001 <±3m), Rauenberg, Bessel
- DHDN/PD (DE old states south <±1m), Rauenberg, Bessel
- DHDN/PD (DE old states middle <±1m), Rauenberg, Bessel
- DHDN/PD (DE old states north <±1m), Rauenberg, Bessel
- S42/83 (DE states MV/LSA <±1m), Pulkowo, Krassowskij
- RD/83 (DE new states <±1m), Rauenberg, Bessel
- PD/83 (DE state TH <±1m), Rauenberg, Bessel
- SOLDNER (DE state BY <±1m), Munich, Laplace
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Prussian Land Register (PK)

- DHDN/PD (DE 1995 <±5m), Rauenberg, Bessel
- DHDN/PD (DE 2001 <±3m), Rauenberg, Bessel

Great Britain (GB)

- ETRS89 (Europe), geocentric, GRS80
- OSGB36 (GB/IE), Herstmonceux, Airy
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Greece (GR)

- GGRS87 (GR), Dionysos, GRS80
- ED50 (GR), Potsdam, Hayford/Int.
- HELLENIC (GR <±3m), Athens, Bessel
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

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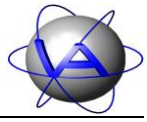

Hungary (HU)

- HD72 (HU), Szölöhegy, GRS67
- S42/83 (East Europe), Pulkowo, Krassowskij
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Ireland (IE)

- ETRS89 (Europe), geocentric, GRS80
- IRELAND65 (IE), Slieve Donard, Airy modified
- OSGB36 (GB/IE), Herstmonceux, Airy
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Italy (IT)

- ETRS89 (Europe), geocentric, GRS80
- ROMA40 (IT), Monte Mario, Hayford/Int.
- ROMA40 (IT-peninsular <±4m), M. Mario, Hayford/Int.
- ROMA40 (IT-Sardinia <±4m), M. Mario, Hayford/Int.
- ROMA40 (IT-Sicily <±4m), Monte Mario, Hayford/Int.
- ED50 (Europe), Potsdam, Hayford/Int.
- ED50 (IT Sardinia), Potsdam, Hayford/Int.
- ED50 (IT Sicily), Potsdam, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Latvia (LV)

- LKS92 (LV), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- S42 (LV), Pulkowo, Krassowskij
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84

Liechtenstein (LI)

- ETRS89 (Europe), geocentric, GRS80
- CH1903+ (CH/LI 1993), Zimmerwald, Bessel
- CH1903 (CH/LI), Bern, Bessel
- CHTRS95 (CH/LI), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84

Lithuania (LT)

- LKS94 (LT), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- S42 (LT), Pulkowo, Krassowskij
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84

Luxembourg (LU)

- ETRS89 (Europe), geocentric, GRS80
- LUREF (LU), Habay, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.
- NTF (FR), Paris Pantheon, Clarke IGN

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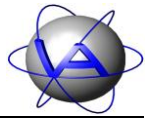

Malta (MT)
- ED50 (MT), Potsdam, Hayford/Int.
- WGS84 (World wide GPS), geocentric, WGS84

Netherlands (NL)
- ETRS89 (Europe), geocentric, GRS80
- RD/NAP (NL), Amersfoort, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Norway (NO)
- NGO1948 (NO), Oslo, Bessel modified
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- ED50 (NO FI), Potsdam, Hayford/Int.
- ED50 (Europe), Potsdam, Hayford/Int.

Poland (PL)
- ETRS89 (Europe), geocentric, GRS80
- S42/58 (PL Uklad 1965), Pulkowo, Krassowskij
- S42/83 (PL), Pulkowo, Krassowskij
- S42/83 (East Europe), Pulkowo, Krassowskij
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Portugal (PT)
- DLX (PT), Lisbon, Hayford/Int.
- D73 (PT), Melrica, Hayford/Int.
- ED50 (PT), Potsdam, Hayford/Int.
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Slovakia (SK)
- ETRS89 (Europe), geocentric, GRS80
- S-JTSK (SK), Hermannskogel, Bessel
- S42/83 (East Europe), Pulkowo, Krassowskij
- MGI (AT/CZ), Hermannskogel, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Slovenia (SI)
- D48 (SI), Hermannskogel, Bessel
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

Spain (ES)
- MADRID1870 (ES <±7m), Madrid, Struve
- ED50 (ES EST99 peninsular), Potsdam, Hayford/Int.
- ED50 (ES ZNW99 northwest), Potsdam, Hayford/Int.
- ED50 (ES BAL99 Balearic isl.), Potsdam, Hayford/Int.
- ETRS89 (Europe), geocentric, GRS80

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- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Sweden (SE)

- RT90 (SE), Stockholm, Bessel
- SWEREF99 (SE), geocentric, GRS80
- ETRS89 (Europe), geocentric, GRS80
- WGS84 (World wide GPS), geocentric, WGS84
- ED50 (Europe), Potsdam, Hayford/Int.

Switzerland (CH)

- ETRS89 (Europe), geocentric, GRS80
- CH1903+ (CH/LI 1993), Zimmerwald, Bessel
- CH1903 (CH/LI), Bern, Bessel
- CHTRS95 (CH/LI), geocentric, GRS80
- GRANIT87 (CH), Zimmerwald, Bessel
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- ED50 (Europe), Potsdam, Hayford/Int.

NORTH AMERICAN International

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

NORTH AMERICAN Multinational

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- GRS80a Authalic Sphere (US+CA), Sphere, Sphere

Canada - Mean Territory (CA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA <±15m), Kansas, Clarke
- NAD27 (CA east <±6m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - British Columbia & Alberta (CA-BC+AB)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA-BC+AB <±8m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - Maritime Provinces (CA-MPR)

- NAD83 (US+CA), geocentric, WGS84
- ATS77 (CA-MPR), geocentric, WGS72
- NAD27 (CA east <±6m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72
- Canada - North West Territories (CA-NWT)
- NAD83 (US+CA), geocentric, WGS84

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- NAD27 (CA-NWT <±5m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - Ontario & Manitoba (CA-ON+MN)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA-ON+MN <±9m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - Quebec (CA-QUE)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA east <±6m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

Canada - Yukon (CA-YUK)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (CA-YUK <±8m), Kansas, Clarke
- NAD27 (CA <±15m), Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Alabama (US-AL)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Alaska (US-AK)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US-AK), Meade's Ranch Kansas, Clarke
- NAD27 (US-AK Aleutian east), Kansas, Clarke
- NAD27 (US-AK Aleutian west), Kansas, Clarke
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - American Samoa (US-AS)

- American Samoa 1962 (US-AS), Samoa, Clarke
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Arizona (US-AZ)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

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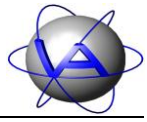

USA - Arkansas (US-AR)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - California (US-CA)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Colorado (US-CO)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Conneticut (US-CT)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- GS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Delaware (US-DE)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Florida (US-FL)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Georgia (US-GA)
- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Hawaii (US-HI)
- NAD83 (US+CA), geocentric, WGS84
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- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

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USA - Idaho (US-ID)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Illinois (US-IL)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Indiana (US-IN)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Iowa (US-IA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Kansas (US-KS)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Kentucky (US-KY)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Louisiana (US-LA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Maine (US-ME)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Maryland (US-MD)

- NAD83 (US+CA), geocentric, WGS84

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- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Massachusetts (US-MA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Michigan (US-MI)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Minnesota (US-MN)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Mississippi (US-MS)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Missouri (US-MO)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Montana (US-MT)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Nebraska (US-NE)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Nevada (US-NV)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke

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- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - New Hampshire (US-NH)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - New Jersey (US-NJ)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - New Mexico (US-NM)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - New York (US-NY)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - North Carolina (US-NC)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - North Dakota (US-ND)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Ohio (US-OH)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Oklahoma (US-OK)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

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USA - Oregon (US-OR)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Pennsylvania (US-PA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Puerto Rico (US-PR)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Rhode Island (US-RI)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - South Carolina (US-SC)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - South Dakota (US-SD)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Tennessee (US-TN)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Texas (US-TX)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Utah (US-UT)

- NAD83 (US+CA), geocentric, WGS84

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- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Vermont (US-VT)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Virgin Islands (US-VI)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Virginia (US-VA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Washington (US-WA)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - West Virginia (US-WV)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Wisconsin (US-WI)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US east), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

USA - Wyoming (US-WY)

- NAD83 (US+CA), geocentric, WGS84
- NAD27 (US), Meade's Ranch Kansas, Clarke
- NAD27 (US west), Meade's Ranch Kansas, Clarke
- WGS84 (World wide GPS), geocentric, WGS84
- WGS72 (World wide), geocentric, WGS72

User Defined

- User defined geodetic datum shift
- No geodetic datum shift
- No datum shift and no ellipsoid transition

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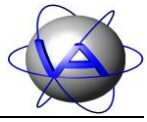

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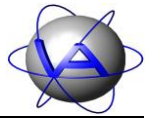

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